Service Manual

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Dear Service Technician

General remarks

This Service Manual is intended to show you how to perform service and corrective maintenance work on the TransPocket 1500 (TP 1500). You will find it well worthwhile to read through the Service Manual carefully and to follow all the instructions it contains. This will help you to avoid malfunctions caused by errors made in the course of inspection, service and maintenance. The unit will repay you by giving its users constant operational readiness for many years to come.

Safety

Warning! Work performed incorrectly, can cause serious injury and damage. Inspection, service and maintenance of this machine may only be carried out by trained personnel, and only in accordance with the technical directions. Before you start using the machine or carrying out any inspection, service and maintenance work on it, you must first read the section headed "Safety rules".

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Safety rules

Danger!

"Danger!" indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations. This signal word is not used for property damage hazards unless personal injury risk appropriate to this level is also involved.

Warning!

"Warning!" indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. This signal word is not used for property damage hazards unless personal injury risk appropriate to this level is also involved.

Caution!

"Caution!" indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert alert against unsafe practices that may cause property damage.

Note!

"Note!" indicates a situation which implies a risk of impaired welding result and damage to the equipment.

Important!

"Important!" indicates practical hints and other useful special-information. It is no signal word for a harmful or dangerous situation.

Whenever you see any of the symbols shown above, you must pay even closer attention to the contents of the manual!

General remarks

This power source has been made in accordance with the state of the art and all recognised safety rules. Nevertheless, incorrect operation, faulty inspection, servicing and repairing or misuse may still lead to danger for

- the life and well-being of the welder or of third parties,
- the power source and other tangible assets belonging to the owner/ operator,
- efficient working with the power source.

All persons involved in any way with starting up, operating, servicing and reparing the power source must

- be suitably qualified
- be sufficiently knowledgeable about welding and
- follow exactly the instructions given in this service manual.

Any malfunctions which might impair machine safety must be eliminated immediately.

It's your safety that's at stake!

Utilisation for intended purpose only

The power source may only be used for jobs as defined by the “Intended purpose” (see the section of the Operating Instructions headed “Starting to use the welding machine”).

Utilisation in accordance with the “Intended purpose” also comprises
- following all the instructions given in this service manual
- performing all stipulated inspection and servicing work
- exact compliance with the prescribed measurement, testing and corrective maintenance work described herein.

The power source is designed to be used in industrial and workshop environments. The manufacturer shall not be liable for any damage resulting from use of the power source in residential premises.

Ambient conditions

Operation or storage of the power source outside of the stipulated range is deemed to be “not in accordance with the intended use”. The manufacturer shall not be liable for any damage resulting herefrom.

Temperature range of ambient air:
- when welding: - 10 °C to + 40 °C
- when being transported or stored: - 25 °C to + 55 °C

Relative atmospheric humidity:
- up to 50 % (at 40 °C)
- up to 90 % (at 20 °C)

Ambient air: Free of dust, acids, corrosive gases or substances etc.

Elevation above sea level: Up to 2000 m

Obligations of owner/operator

The owner/operator undertakes to ensure that the only persons allowed to work with the power source are persons who
- are familiar with the basic regulations on workplace safety and accident prevention, and who have been instructed in how to operate the power source
- have read and understood the sections on safety rules and the warnings contained in this service manual, and have confirmed as much with their signatures

Regular checks must be performed to ensure that personnel are still working in a safety-conscious manner.

Obligations of personnel

Before starting work, all persons entrusted with carrying out work on the power source shall undertake
- to observe the basic regulations on workplace safety and accident prevention
- to read the sections on safety rules and the warnings contained in this service manual, and to sign to confirm that they have understood these

All workplaces must be inspected and checked regularly after work has finished.

Personal protective equipment

For your personal safety, take the following precautions:

Wear stout footwear that will also insulate even in wet conditions

Protect your hands by wearing insulating gloves

Protect your eyes from UV rays with a safety shield containing regulation filter glass

Only use suitable (i.e. flame-retardant) clothing

Where high noise levels are encountered, use ear-protectors

Where other persons are nearby during welding, you must
- instruct them regarding the dangers,
- provide them with protective equipment and/or
- erect protective partitions or curtains.

Hazards from noxious gases and vapours

Extract all fumes and gases away from the workplace, using suitable means.

Ensure a sufficient supply of fresh air.

Keep all solvent vapours well away from the arc radiation.

Hazards from flying sparks

Move all combustible objects well away from the welding location.

Welding must NEVER be performed on containers that have had gases, fuels, mineral oils etc. stored in them. Even small traces of these substances left in the containers are a major explosion hazard.

Special regulations apply to rooms at risk from fire and/or explosion. Observe all relevant national and international regulations.

Hazards from mains and welding current

An electric shock can be fatal. Every electric shock is hazardous to life.

All welding cables must be firmly attached, undamaged and properly insulated. Replace any loose connections and scorched cables immediately.

Have the mains and the appliance supply leads checked regularly by a qualified electrician to ensure that the PE conductor is functioning correctly.

Only run the power source on a mains network with a PE conductor and plugged into a power outlet socket with a protective-conductor contact.

If the power source is run on a mains network without a PE conductor and plugged into a power outlet socket without a protective-conductor contact, this counts as gross negligence and the manufacturer shall not be liable for any resulting damage.

Unplug the power source from the mains. After opening up the welding machine, make absolutely sure that this is “dead”. Discharge any components that may store an electrical charge.

If work needs to be performed on any live parts, there must be a second person on hand to switch off the machine at the main switch in an emergency.

Hazards when the machine housing is open

Whenever testing is being performed while the machine is still plugged into the mains or after opening the housing, observe the following points:

- Do not touch the power source, or any of its components
- Remember that bare, electrically live parts such as exposed connections on the mains switch, or soldering points on the LCA51 board, present a particular hazard
- Owing to the high open-circuit voltage (92 V), there is also a risk on the secondary side (around the secondary diode and the welding sockets)
- Components that store an electrical charge continue to be dangerous even after the machine has been unplugged from the mains
- Wherever possible, discharge components such as these after unplugging the machine from the mains

Vagrant welding currents

If the following instructions are not observed, vagrant welding currents may occur. These can destroy earthed conductor terminals, the power source and other electrical equipment

Ensure that the workpiece clamp is connected tightly to the workpiece

If the floor is electrically conductive, set up the welding machine on an insulated base

EMC precautions

It is the responsibility of the owner/operator to ensure that no electromagnetic interference is caused to electrical and electronic equipment.

If electromagnetic interference is found to be occurring, the owner/operator is obliged to take all necessary measures to prevent this interference.

Evaluation of possible electromagnetic problems that may occur on equipment in the vicinity, and of the degree of immunity of this equipment as per the CE Declaration of Conformity:

- safety features
- mains, signal and data-transmission leads
- IT and telecoms equipment
- measurement and calibration devices
- the health of persons in the vicinity, e.g. users of heart pacemakers and hearing aids
- users of heart pacemakers must take medical advice before going anywhere near welding workplaces

Ancillary measures for preventing EMC problems:

a) Mains supply
- If electromagnetic interference still occurs, despite the mains connection being in accordance with the regulations, take additional measures (e.g. mains filter)

b) Welding cables
- Keep these as short as possible
- Arrange them so that they run close together
- Lay them well away from other leads

c) Equipotential bonding

d) Workpiece earthing
- where necessary, run the connection to earth via suitable capacitors

e) Shielding, where necessary
- Shield other equipment in the vicinity
- Shield the entire welding installation

Particular danger spots

Do not touch the workpiece during or after welding - risk of injury from burning!

Special regulations apply to rooms at risk from fire and/or explosion. Observe all relevant national and international regulations.

Power sources for use in spaces with increased electrical danger (e.g. boilers) must be identified by the S (for “safety”) mark.

Welding-joins to which special safety requirements apply must only be carried out by specially trained welders.
When using a testing unit for the insulation test, never touch the test-prods (high voltage).

Informal safety precautions

The service manual must be kept at the power source location at all times.

In addition to the service manual, copies of both the generally applicable and the local accident prevention and environmental protection rules must be kept on hand, and of course observed in practice.

All the safety instructions and danger warnings on the power source itself must be kept in a legible condition.

Safety precautions at the installation location

The power source must be placed on an even, firm floor in such a way that it stands firmly. A power source that topples over can easily kill someone!

Special regulations apply to rooms at risk from fire and/or explosion - observe all relevant national and international regulations.

By means of internal instructions and checks, ensure that the workplace and the area around it are always kept clean and tidy.

Safety precautions in normal operation

Only operate the power source if all its protective features are fully functional.

Before switching on the power source, ensures that nobody can be endangered by your turning on the machine.

At least once a week, check the power source for any damage that may be visible from the outside, and check that the safety features all function correctly.

Safety inspection

The owner/operator is obliged to have the power source checked by a trained electrician to ensure that it is in a proper condition after any alterations, installations of additional components, modifications, repairs, care and maintenance, and in any case at least every twelve months.

Further information on corrective maintenance, modification and inspection of welding power sources is available from your regional or national Fronius service centre,who will be pleased to provide you with a copy of the Work Instruction "Safety Inspection of Welding Machinery" (AA-PMÜ-01) upon request.

Standard	Title
IEC (EN) 60 974-1	Arc welding equipment, Part 1: Welding power sources
BGV A2, §5	Electrical plant and facilities
BGV D1, §33 / §49	Welding, cutting and allied processes
VDE 0701-1	Repair, modification and inspection of electrical appliances - Part 1: General requirements
VDE 0702-1	Repeat tests on electrical appliances

Alterations to the power source

Do not make any alterations, installations or modifications to the welding machine without getting permission from the manufacturer first.

Replace immediately any components that are not in perfect condition.

Spares and wearing parts

Use only original spares and wearing parts. With parts sourced from other suppliers, there is no certainty that these parts will have been designed and manufactured to cope with the stressing and safety requirements that will be made of them.

When ordering spare parts, please state the exact designation and the relevant part number, as given in the spare parts list. Please also quote the serial number of your power source.

Calibration of power sources

In view of international standards, regular calibration of power sources is advisable. Fronius recommends a 12-month calibration interval. For more information, please contact your Fronius partner!

CE-marking

The power source fulfils the fundamental requirements of the Low-Voltage and Electromagnetic Compatibility Directive and is thus CE-marked.

Copyright

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Technical data - Rating plate

Rating plate

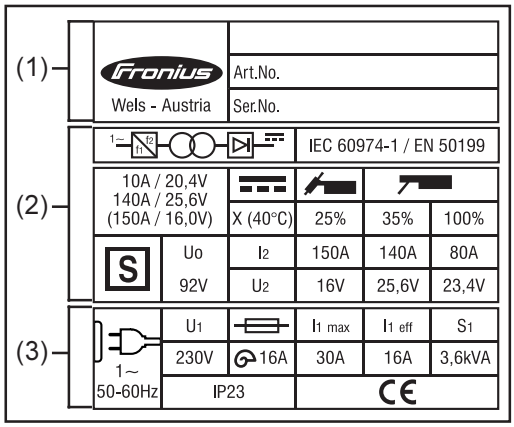

Fig.1 Rating plate on the TP 1500 power source

All the relevant data for the TP 1500 power source may be found on the rating plate.

Legend:
(1) Identification
(2) Data regarding weld process
(3) Data regarding power supply

Identification

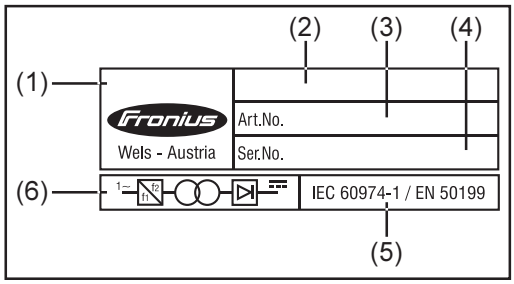

Fig.2 "Identification" section

The "Identification" section of the rating plate contains the manufacturer's symbol and the place of origin, together with the type (model), article number and serial number of the power source. The symbol for the functional principle of the power source, and the Standards with reference to which it was developed, produced and given final inspection & testing, are also shown here.

Legend:
(1) Manufacturer's symbol, place of origin
(2) Type designation (trade name) of the power source
(3) Article number of the power source
(4) Serial number of the power source "XXYYZZZZ" (8-digit)
(Code: XX=year, YY=calendar week, ZZZZ=serial number)
(5) Statement of the Standards governing the development, manufacture and final testing & inspection of the power source
(6) Symbol for the functional principle of the power source according to the inverter principle (see Section "4. General basics - Functional principle")

Data regarding weld process

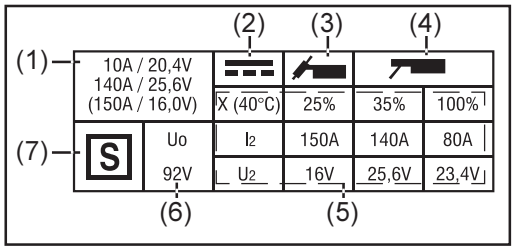

Fig.3 "Weld-process data" section

The "Weld-process data" section gives information on the weld process for which the power source is intended (here = rod-electrode welding and TIG welding with contact ignition).

This section also states the welding-amperage range, the maximum permissible welding amperage (for the respective duty cycle) and the respective output voltages.

Legend:
(1) Adjustable welding-amperage range with the relevant values for the output voltage
(2) Symbol for the type of welding current (here: direct current = DC)
(3) First weld process for which the power source is intended
(here = rod-electrode welding)
(4) Second weld process for which the power source is intended
(here = TIG welding with contact ignition)
(5) Maximum permissible values for welding current and the respective welding voltage
- at the stated ambient temperature (here: 40 °C) and
- for the respective duty cycles (here: 25 %, 35 % and 100 %)
(6) Rated open-circuit voltage (here: 92 V)
(7) Symbol for power sources that are suitable for welding in conditions of increased electrical hazard

Duty cycle

Important! When comparing duty-cycle data, remember that Fronius assumes an ambient temperature of 40 °C. Even if the ambient temperature is only marginally lower, considerably longer duty cycles are possible.

The duty cycle is stated in % and refers to a 10-minute cycle.

At the stated ambient temperature and at the stated welding amperage, uninterrupted welding is possible for the stated %age of this 10-minute period.

For the rest of the 10-minute cycle, the power source cuts out (“Error” indicator lights up). Once the power source has switched itself back on again, welding can be resumed immediately.

Important! The power source is designed so that after the appropriate pause periods, the 10-minute cycle can be repeated an unlimited number of times.

Even at maximum welding amperage, the possible duty cycles are usually more than sufficient, and are often prolonged in any case by:
- the (unavoidable) need to change the electrode from time to time
- the fact that weld-seams are not of unlimited length, and
- the fact that more often than not, the ambient temperature will be below 40°C anyway.

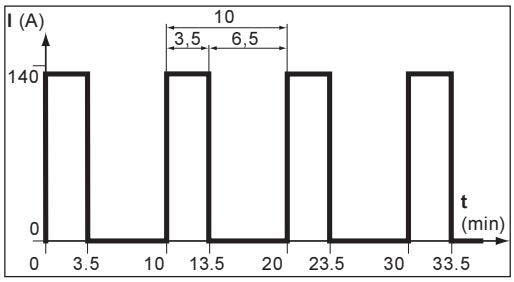

Fig.4 35 % duty cycle, with a welding amperage of 110 A

Example of the duty cycle stated on the rating plate, at a welding amperage of 140 A and selected welding process “rod-electrode welding“ (Fig.4):
- duty cycle is 35 %
- at an ambient temperature of 40 °C
- This means:
  - 3.5 minutes’ welding
  - 6.5 minutes’ pause

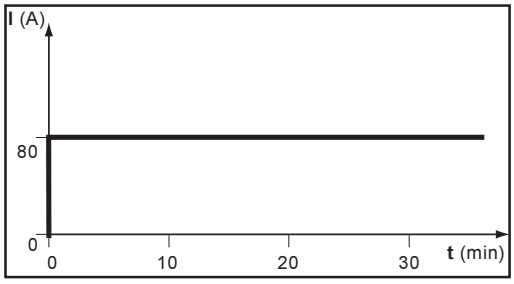

Fig.5 100 % duty cycle, witha welding amperage of 80 A

Example of the duty cycle stated on the rating plate, at a welding amperage of 80 A and selected welding process “rod-electrode welding“ (Fig.5):
- duty cycle is 100 % (continuous operation)
- at an ambient temperature of 40 °C
- This means:
  - welding is possible for an unlimited period of time

Data regarding power supply

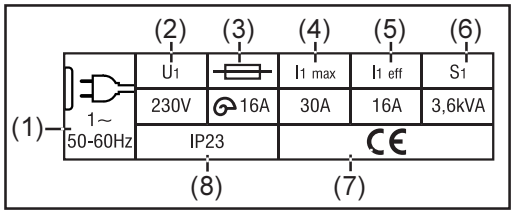

Fig.6 "Data regarding power supply" section

The section on "Data regarding power supply" provides information on the required mains power connection and the necessary mains fuse protection. Other data given here relate to the power consumption, the degree of protection and the CE-labelling of the power source.

Legend:

(1) Symbol for the mains connection (number of phases, type of voltage, frequency) (here: 1 phase, alternating current 50-60 Hz)
(2) Mains voltage (here: 230 V)
(3) Symbol for mains fuse protection + "Snail symbol" for "slow-blow" (here: 16 A slow)
(4) Power consumption (here: 30 A) at maximum welding amperage (110 A) for the welding process "Rod-electrode welding" and corresponding output voltage as per the standard characteristic (25.6 V)
(5) Mean power consumption (here: 16 A) over the entire 10-minute duty cycle, determined from
- *power consumption (as per Point 4) during the welding cycle*
- *open-circuit power consumption during the pause cycle*

***N.B.!** The mean power consumption is the basis for determining what level of fuse protection should be used.*

(6) Apparent power, computed as the product of mean power consumption 5 x mains voltage (2) (here: 16 A x 230 V = 3.68 kVA)
(7) CE labelling
(8) Protection class as defined in the Standard (here: IP 23 = suitable for use on worksites)

Standard characteristic

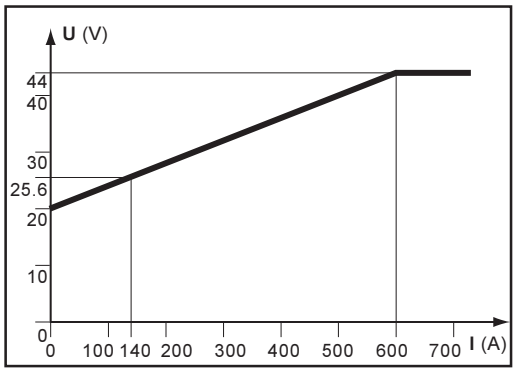

Fig.7 Standard characteristic for rod-electrode welding

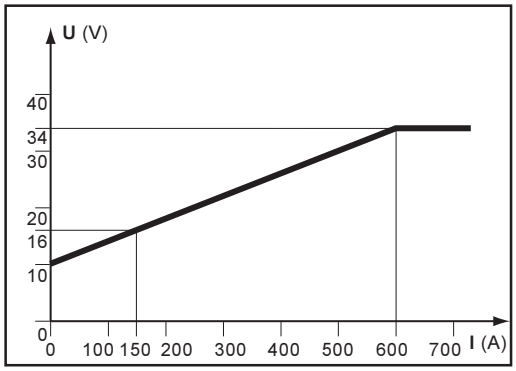

Fig.8 Standard characteristic for WIG welding

As mentioned in the section headed "Data regarding power supply", the power consumption (4) - Fig.6 - is established when the maximum welding current is applied, with reference to the corresponding output voltage as per the Standard characteristic.

The Standard characteristic represents a standardised ratio of welding voltage to welding amperage

Figure 7 shows the standard characteristics for rod-electrode welding
Figure 8 shows the standard characteristics for TIG welding

Because the welding voltage measured at the maximum welding current reaches various different values, as dictated by the conditions prevailing at the arc, it would not be possible to make any concrete statement on the maximum power consumption (4) - Fig.6 - without a defined current/voltage ratio.

Set-up regulations

The power source is tested to “Degree of protection IP23”, meaning:

- Protection against penetration by solid foreign bodies with diameters larger than 12 mm
- Protection against spraywater up to an angle of 60° to the upright

The power source can be set up and operated outdoors in accordance with IP23. However, the built-in electrical components must be protected against direct wetting.

Warning! A welding machine that topples over can easily kill someone! Place the welding machine on an even, firm floor in such a way that it stands firmly.

Note! The venting duct is a very important safety feature. When choosing the machine location, make sure that it is possible for the cooling air to enter and exit unhindered through the louvers on the front and back of the machine. Any metallic dust from e.g. grinding-work must not be allowed to get sucked into the power source.

Mains connection

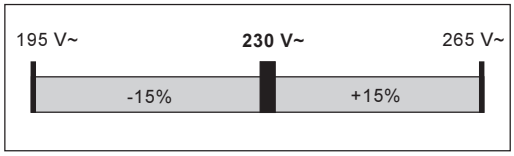

Fig.9 Tolerance ranges of the mains voltage

The power source is designed to run on the mains voltage given on the rating plate. The mains cable and plug are ready-mounted. For details of fuse protection of the mains supply lead, please see the Technical Data.

The power source can be run as standard on a mains voltage of 230 V~ (+/- 15%).

Thanks to its +/-15% tolerance range, the power source can also be run on the 220 V~ and the 240 V~ mains.

Note! Operation with the wrong mains voltage will invalidate all warranty claims.

Note! If the power source is designed to run on a special voltage, the Technical Data shown on the rating plate apply. The mains plug and mains supply lead, and their fuse protection, must be dimensioned accordingly.

- The mains plug used must correspond exactly to the mains voltage and current rating of the power source in question, as given in the Technical Data!

- The fuse protection for the mains lead should be suitable for the current consumption of the power source!

General basics - Functional principle

Inverter principle - General remarks

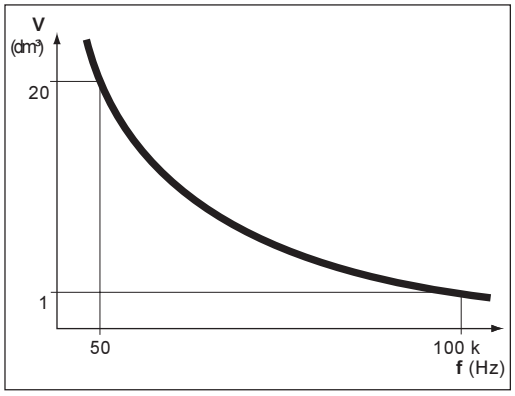

Fig.1 Volume of a transformer, as a function of its frequency

The TP 1500 power source functions by the inverter principle. The distinguishing feature of inverter power sources is that the welding transformer's location in the energy path does not come until after the switching transistor. This enables the transformer to be designed for a much higher frequency, regardless of the (50 Hz) mains frequency. The reason for this is an electrotechnical law which dictates that the weight and volume of a transformer will depend on the frequency at which it is operated. The higher the frequency, the lower the volume of the transformer.

It is precisely this connection between volume and frequency that is exploited by inverter power sources. This is the reason why inverter power sources can have low weight and compact dimensions without sacrificing power and performance. As a result, they are much lighter to carry, which is particularly important for use out in the field. Also, thanks to their small volume, inverters take up less space in the often cramped conditions found in workshops.

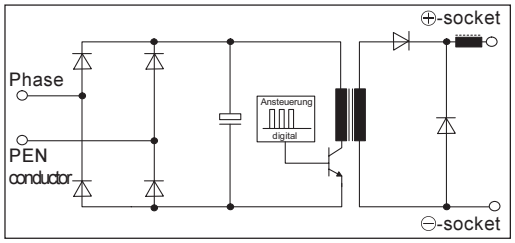

Fig.2 Block diagram of an inverter power source

Another advantage is their high electrical efficiency (up to 90%). Before the high switching frequency can be exploited, the mains voltage must first be rectified in the primary rectifier. The DC voltage delivered by the primary rectifier is converted to a high frequency with the aid of a transistor switch. This is what gives "inverter" power sources their name (to invert = to convert or transform).

Following this, the high-frequency voltage is fed to the transformer. The output voltage from the transformer is then rectified once again in the secondary rectifier (secondary diode).

On inverter power sources, the welding properties do not depend on the design of the transformer and the output inductor. This makes it possible to flexibly adapt the power source characteristic to the job in hand.

Resonance converter

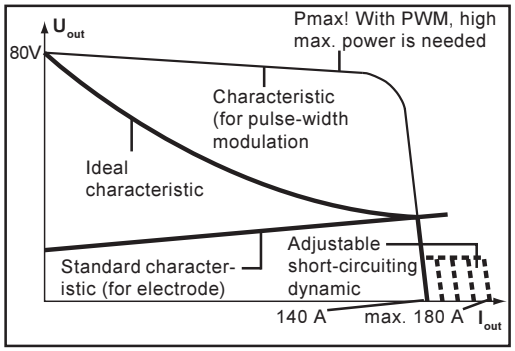

Fig.3 Characteristic on resonance converter, rod-electrode

Based on the inverter principle, the development effort to develop the resonance converter for the TP 1500 power source took wholly new approaches. Instead of a simple transistor switch or pulse-width modulation, the principle of a resonance converter is used for generating the high-frequency primary voltage.

Resonance converter (continued)

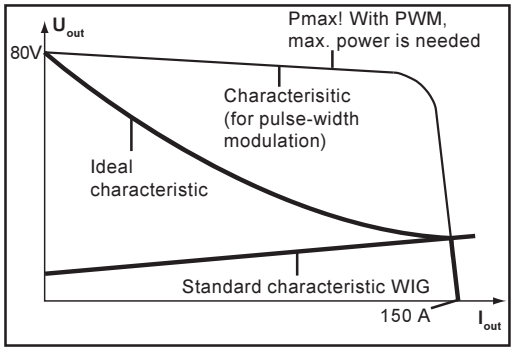

Fig.4 Characteristic on resonance converter, WIG

In spite of the complicated controlling system needed for use in welding, the resonance-converter principle offers a number of useful advantages:

- The resonance structure makes it possible to achieve a nearly “ideal output characteristic”
- Reduced switching losses permit higher switching frequencies yet with optimum efficiency

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- The fact that the characteristic is relatively flat in the vicinity of the operating point prevents unnecessarily high output powers
- This not only has a positive effect on the power consumption, but also helps to avoid overdimensioned components
- Although it dispenses with all the weight and space-intensive auxiliary components that used to be added in order to improve the welding properties, it nevertheless still achieves superlative results

Series resonance converter

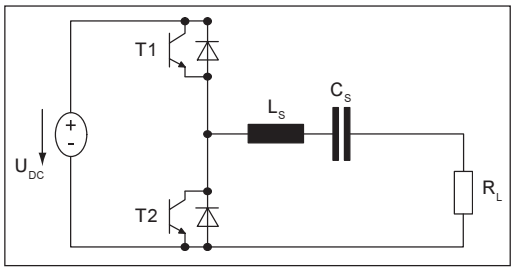

Fig.5 Series resonance converter

A series resonance converter consists of the following components:

- series resonance circuit (coil and capacitor)
- load resistor
- transistors for addressing the resonant circuit

Transistors T1 and T2 are addressed alternately

If transistor T1 becomes conductive, the series resonance circuit (i.e. coil and capacitor) generates a positive, sinusoidal half-wave that is discharged via the resistor R_L.
The negative half-wave resulting from the oscillatory behaviour of the series resonance circuit flows via: R_L, the capacitor C, the coil L_S and the transistor T2 (as soon as transistor T2 becomes conductive).

If the addressing frequency is identical with the resonance frequency of the series resonance circuit, the output voltage at the load resistor R_L will correspond to the input voltage U_{DC}. At higher or lower frequencies (relative to the resonance frequence) the output voltage will decrease. This is the means by which the resonance converter can be controlled.

Series-parallel resonance converter

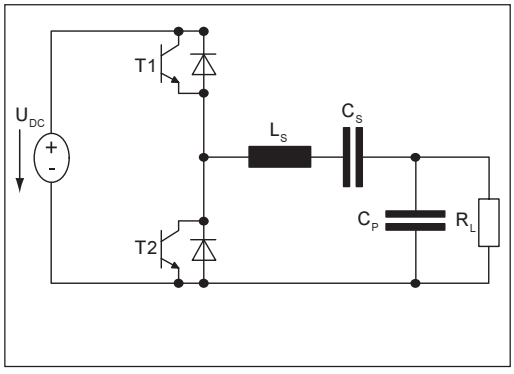

Fig.6 Series-parallel resonance converter

The outcome of further development work on the series resonance converter is the “series-parallel resonance converter”:

The series-parallel resonance converter has an additional capacitor C_P, which is connected in parallel to the resistor R_L. Together with R_L , the capacitors C_S and C_P constitute a loaded capacitive voltage divider. For this reason, the resonance circuit (coil and capacitor) has a capacitor component that is divided up into C_S and C_P.

Series-parallel resonance converter (continued)

The voltage increase occurring in the “resonant frequency” region, in the capacitor component, is thus available partly on capacitor C_P and partly on load resistor R_L . On resistor R_L , a voltage arises which may be higher than the input voltage. This effect is encouraged by a high load resistance, which shunts out the capacitor C_P to the minimum possible extent.

Increasing the output voltage by means of series-parallel resonance

The “series-parallel resonance converter” principle utilised for the resonance inverter of the TP 1500 power source makes possible an output voltage that climbs exponentially the higher the load resistance is increased (see Fig.3, “ideal characteristic”) and that must be limited in open circuit.

An increased load resistance means a longer arc or an arc that threatens to break at any moment. On the other hand, the climbing voltage counteracts any tendency to break on the part of the arc.

Limiting the increased output voltage in open circuit

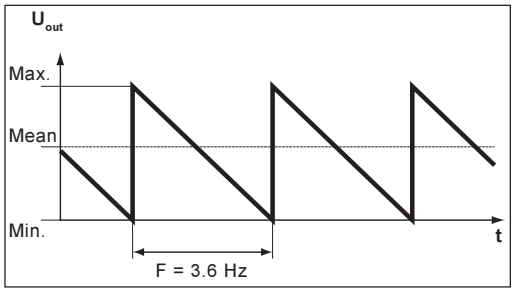

Fig.7 Output voltage in open circuit

Because virtually unlimited output voltage is possible in the open circuit, the open-circuit voltage applied to the welding sockets is clocked at a frequency of approx. 3.6 Hz.

The result is a “saw-tooth” output voltage whose minimum and mean values are considerably below those of the unclocked output voltage. The unclocked output voltage would constantly correspond to the maximum.

In the same way as with the series resonance converter, the output voltage is dependent upon the addressing frequency of the switching transistors relative to the resonance frequency. In the case of series-parallel resonance, the maximum voltage increase is also reached in the resonant-frequency region.

Complex regulation

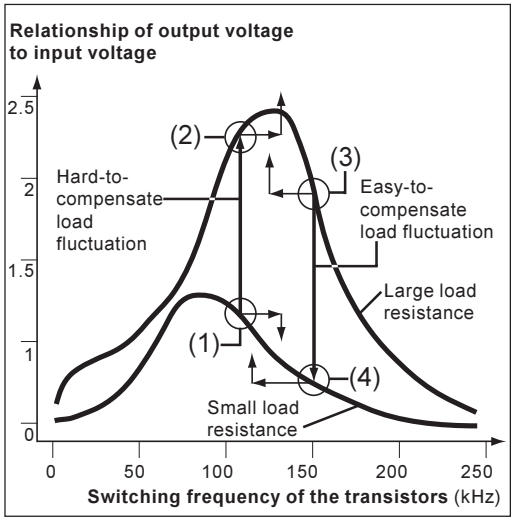

Fig.8 Complex regulation of the output voltage

The great difficulty with series-parallel resonance is to do with the fact that the resonant frequency tends to change along with the load (i.e. with the arc characteristic). This means that as well as the load resistance, the (related) resonant frequency is also a crucial influencing parameter when it comes to regulating a series-parallel resonance converter. Because the necessary addressing frequency for the switching transistors is dependent upon two separate parameters, complex regulation of the output voltage is required.

Legend:
(1) The output voltage tends towards operating point (2) as a result of the load resistance becoming larger
- At operating point (1), an increase in the frequency corresponds to a decrease in the output voltage
- At operating point (2), an increase in the frequency would cause a further increase in the output voltage
- thereby acting contrary to the goal of returning the output voltage to the value for operating point (1)

Complex regulation (continued)

- *A complex regulation strategy is called for*

(3) The output voltage tends towards operating point (4) as a result of the load resistance becoming smaller
- *At operating point (3), a decrease in the frequency corresponds to an increase in the output voltage*
- *Also at operating point (4), a decrease in the frequency corresponds to an increase in the output voltage*
- *By decreasing the frequency, then, the output voltage can be clearly brought back towards the value for operating point (3)*

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Applying the resonance converter principle

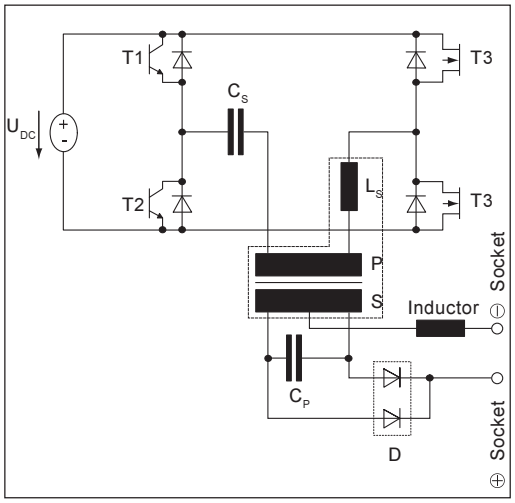

Fig.9 Block diagram of theTP 1500 power-pack

The power transistors T1 and T4 apply the voltage for the positive half-wave to the primary winding of the transformer. The capacitor C_S, the primary winding P and the coil L_S together constitute the series resonance circuit here. The negative half-wave is switched to the series resonance circuit by the power transistors T3 and T2.

The secondary winding S of the transformer transmits the positive and negative half-waves - as the welding current - to the secondary diode D, which actually consists of two separate diodes.

A special feature here is the centre-tap of the secondary winding, which determines the frame potential of the welding voltage.

Positive half-waves are fed to the ⊕ socket via one of the two end-taps of the secondary winding and one of the two secondary diodes. Negative half-waves are routed to the ⊕ socket via the other of the two end-taps and the other secondary diode.

In this way, full-wave rectification is achieved, yet with no need for a space-intensive 4-diode bridge rectifier, which would also generate increased heat-loss. In keeping with the series-parallel resonance converter, the capacitor C_P is located parallel to the load resistor (=welding process).

The increase in the output voltage brought about by capacitor C_P in response to an increase in the load resistance (arc threatens to break) plays a major role in optimising the welding properties. Furthermore, in order to achieve a perfect welding result and outstanding welding properties, the welding current and welding voltage need to be constantly realigned.

Measuring and regulating the parameters “welding current” and “welding voltage”

The parameters “welding current” and “welding voltage” are constantly measured. A microcontroller continually compares the welding current that was pre-set on the setting dial with the actual welding current that is measured by the shunt. The transistors of the power-pack are addressed so as to raise or lower the welding voltage to the value that is needed for keeping the pre-set welding current constant.

Taking the rod-electrode welding process as an example, Fig. 10 shows the working ranges of the power source as a function of the actual condition of the arc.

Measuring and regulating the parameters “welding current” and “welding voltage” (continued)

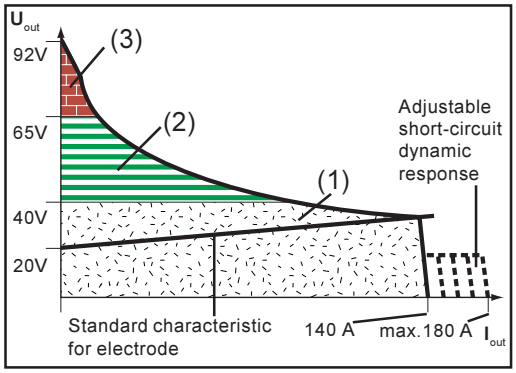

Fig.10 Characteristic / operating ranges of the TP 1500

If a short circuit takes place, there is a brief rise in the amperage. In order to obtain a stable arc, the welding current also increases briefly, in line with the pre-set dynamic - e.g. from 140 A to 180 A (see Fig.10).

If the electrode is threatening to sink into the weld pool, this measure prevents the weld pool from solidifying, as well as preventing more prolonged short-circuiting of the arc. This largely eliminates any risk of the rod electrode “sticking”.

Legend:
(1) Continuous operation
- When the duty cycle is exceeded:
- Power-pack switches off
- “Error” indicator lights up
- Once the cooling phase has elapsed, the power-pack switches back on again
(2) Operation for max. 2 seconds
- If this 2-second period is exceeded:
- Power-pack switches off
- “Error” indicator lights up
- In no-load operation, the power-pack switches back on again
(3) No-load operation
- The sawtooth open-circuit voltage (see Fig.7) is applied to the output sockets

Hot-Start and Anti-Stick functions

The TP1500 TIG, TP 1500 RC and TP 1500 power sources are equipped with the Hot-Start function, which is permanently activated as long as the “rod-electrode welding” process is selected. As soon as the arc is started, the Hot-Start function increases the welding current by one-third of the value originally set on the welding-current dial. This brief increase in the current occurs for a period of 0.5 sec.

Example:
If the pre-set welding current was 90 A, the welding current is increased to 120 A. Where the pre-set welding current is more than 120 A, the Hot-Start current is limited to a maximum of 160 A.

Benefits:
- Improved ignition - even when using electrodes with poor ignition properties
- Better base-metal fusion in the start-up phase, meaning fewer fusion defects
- Largely prevents slag inclusions

Hot-Start and Anti-Stick function
(continued)

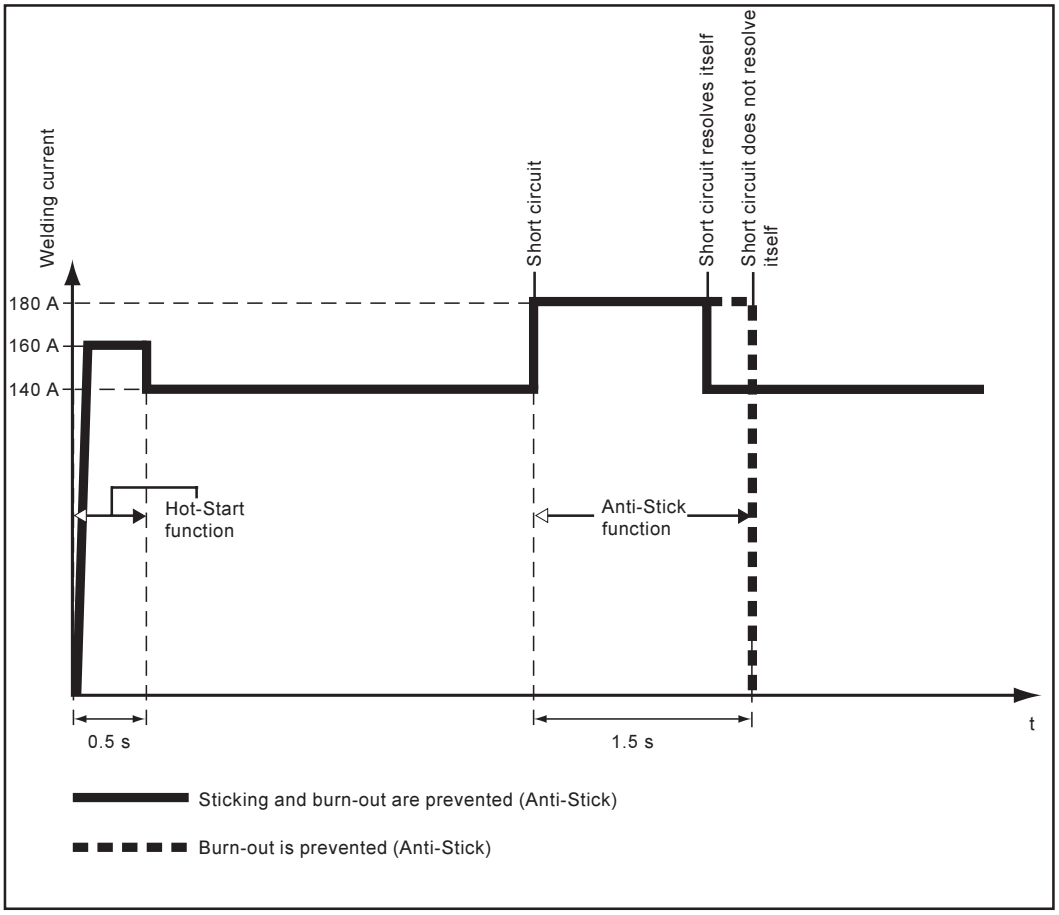

Fig.11 Anti-Stick

The Anti-Stick function is also available when the “rod-electrode welding” process has been selected.

In the case of power sources without the Anti-Stick function, the welding voltage may drop so far when the arc-length is shortened that the rod electrode starts to stick. Also, this may cause the rod electrode to “burn out”.

“Sticking” of the rod electrode is prevented very effectively by the Anti-Stick function. If a short circuit occurs, the welding current is increased for a maximum period of 1.5 seconds.

If the short circuit resolves itself, the welding current is lowered back to the value selected on the setting dial.

The increase in amperage corresponds to the value set for the arc-force dynamic.

If the rod electrode nevertheless begins to stick during this 1.5 second period, the power source will cut out. This prevents the rod electrode from “burning out”.

Fig. 11 shows the welding-current curve where maximum values have been set for welding current and arc-force dynamic.

“TIG-Comfort-Stop” function

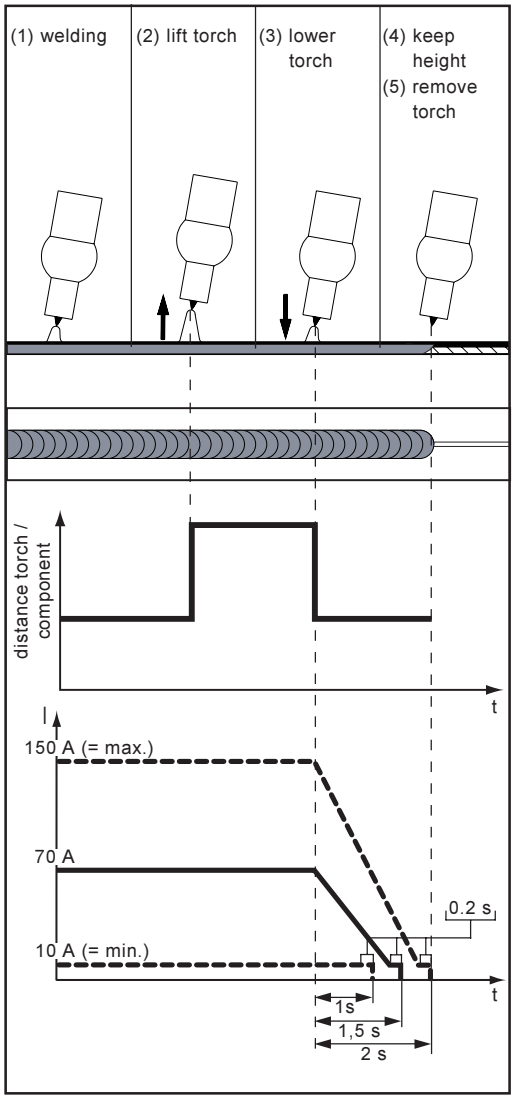

fig.12 TIG-Comfort-Stop

The “TIG Comfort-Stop” function is available on the TP 1500 TIG power source if either the “TIG welding” or “TIG pulsed arc” welding process is selected.

When the “TIG Comfort-Stop” function is selected in the Set-up Menu, crater-filling is possible by means of a downslope.

The downslope is initiated by a defined motion of the welding torch. The downslope causes a ramp decrease of the welding current to the minimum welding current (10 A). The minimum welding current is then kept constant for 0.2 seconds before the arc extinguishes.

The defined motion of the welding torch comprises the following functional sequence: The “TIG Comfort-Stop” function is activated by lifting the torch, causing the arc to become visibly longer. Lowering the torch then triggers the downslope.

Fig.12 shows the sequence of defined torch motions, and the welding current curve.

Downslope:
The downslope is a function of the welding current selected and cannot be adjusted.

- downslope at minimum welding current (10 A) ..... 1 secons
- downslope at maximum welding current (150 A) ..... 2 seconds

Example: At a medium welding current of 70 A the downslope amounts to 1.5 seconds.

Gas flow

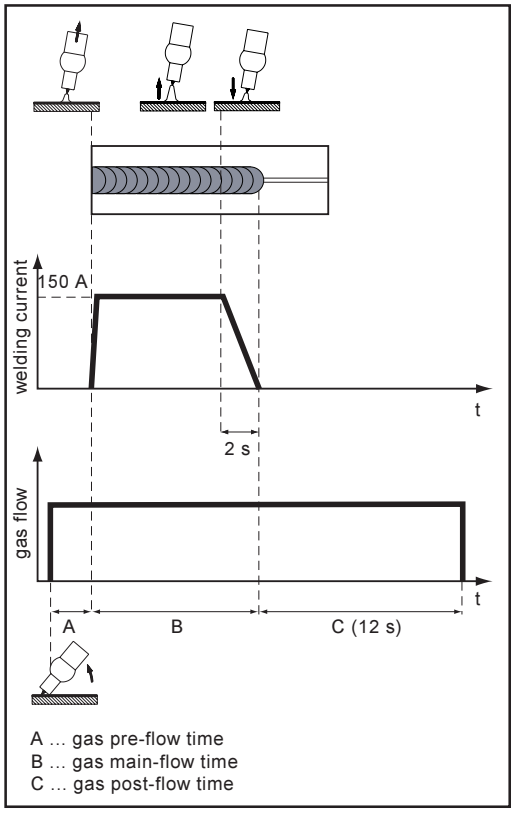

fig.13 gas flow control

The TP1500 TIG power source has an integrated gas connection and a built-in gas solenoid valve that permits intelligent control of the gas flow.

This intelligent gas-flow control ensures that the weld seam is given optimum gas-shielding when either the “TIG welding” or “TIG pulsed arc” welding process is selected. Like the TIG Comfort-Stop function, this function also does without the torch trigger or any control leads.

As long as the welding torch touches the component, the automatic gas pre-flow is carried out. If the contact is kept for more than 3 seconds, the welding current is switched off. Place welding torch again on the ignition point.

The gas flow is carried out until the gas post-flow time has expired.

The gas post-flow time is regulated as a function of the pre-set welding current. Depending on the pre-set welding current (10 A to 150 A), the gas post-flow time will be between 3 and 12 seconds.

- gas post-flow time at minimum welding current (10 A) ..... 3 seconds
- gas post-flow time at maximum welding current (150A) ..... 12 seconds

Example: At a medium welding current of 70 A the gas post-flow time is 7.5 seconds.

Fig.13 shows the gas-flow control sequence where maximum welding current (150 A) has been selected, and where the TIG Comfort-Stop function has been activated.

VRD - Voltage Reduction Device

VRD is an extra safety feature. VRD = voltage reduction device. Wherever possible, VRD prevents output voltages which could be a hazard to life and limb.

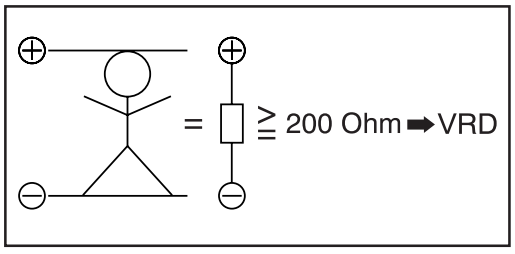

Fig.13a VRD is active

Welding-circuit resistance is larger than the minimum human-body resistance (greater than or equal to 200 ohms):

- VRD is active
- Open-circuit voltage is limited to 12 V
- Example: Accidentally touching both welding sockets at the same time (does not lead to any hazard)

VRD - Voltage Reduction Device
(continued)

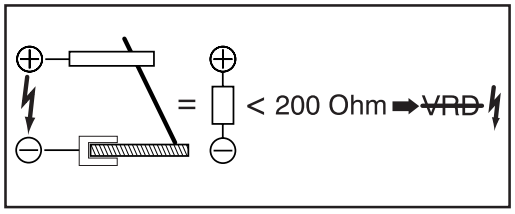

Fig.13b VRD is not active

Welding-circuit resistance is smaller than the minimum human-body resistance (smaller than 200 ohms):
- VRD is inactive
- No limitation of the output voltage, so as to ensure sufficient welding power
- Example: Start of welding

Important! Within 0.3 seconds of the end of welding:
- VRD is active again
- The output voltage is once again limited to 12 V

General basics - how to handle components

ESD precautions

General remarks

Development work on new products always aims to achieve improvements in particular product properties (e.g. optimised welding properties), as well as general improvements in terms of higher performance, longer maintenance intervals, unlimited reliability, and reduced weight and energy consumption.

The result of these efforts is increased use of microelectronic components, even in product areas that have previously used only analogue assemblies.

In order to carry through these quality gains into the field of maintenance and customer service, it is vitally important to ensure that **e**lectrostatic-**s**ensitive **d**evice**s** (ESDS) are also handled in conformity with the relevant guidelines during repair and maintenance work as well.

Throughout the entire sequence of all service activities, from inward delivery of the components to be replaced, all the way through to outward delivery of the repaired machines, consistent protection of the microelectronic components is absolutely essential.

Definition of terms

ESD is the abbreviation of **e**lectro-**s**tatic **d**ischarge.

By electrostatic discharge we mean an equalisation of electrostatic charges when two objects with different potentials approach one another. The charge-equalisation (e.g. between the work-surface and the pin of a component) leads to uncontrolled currents that can damage the component.

ESDS are components that can be damaged by electrostatic discharge or electrostatic fields.

EPA (**e**lectrostatic **p**rotection **a**rea) is the abbreviation given to an ESD protection zone. This is an area in which electrostatic-sensitive devices (ESDS) can be handled with a minimal risk of being damaged by electrostatic discharge or fields, and without exposing staff to any additional risk.

Earthing is provided by a bus installation which restores all connected-up parts of the ESD protection facility (EPA) to a uniform potential.This will normally be the earthing potential. The earthing facility ensures that objects which may come anywhere near the components all have exactly the same potential.

Hazards

International studies show that approx. 25 % of all semiconductor failures are due to the effects of electrostatic charge. Semiconductor failures may also occur as a delayed consequence of damage to a component. When this happens, it is usually impossible to trace what actually caused the component to fail.

Ensure that the following ESD precautions are observed:
- Only work with electrostatic-sensitive devices (ESDS) inside an ESD protection zone (EPA)
- Ensure that the ESD precautions are effective at all times

ESD precautions (continued)

- Outside the EPA, use suitable containers
- Use specially labelled packaging and shipping materials
- If anything is unclear, notify the responsible ESD officer

Protective equipment

In the electrostatic protection areas (EPA's), the following ESD protective equipment is used. All of this equipment is connected to the shared earthing facility via a defined resistance (uniform potential):

- Work surfaces
- Floors
- Discharging wrist-bands
- ESD-compatible seating

Connect up the wrist-bands to the (suitably labelled) earthing points. The ESD officer is obliged to inspect the protective precautions once a month, or to arrange such inspection thereof.

Symbols

- Label identifying an electrostatic protection area (EPA)

- Label identifying electrostatic-sensitive devices (ESDS)

- Label identifying an earthing point

Heat dissipation from power componentry

General remarks

When it comes to servicing the TP 1500 power source, the secondary diode and the transistor module (on the LCA 15 board), are especially critical components. Both the secondary diode and the transistor module are power-semiconductor devices that are attached to the heat-sink on the power source.

The power-semiconductor devices emit large amounts of heat, which has to be transmitted to the heat sink across a relatively small contact area. Smooth operation of the power source can only be guaranteed as long as effective heat-transfer takes place from the secondary diode or transistor module to the heat-sink.

If this heat transfer is impaired in any way, this will swiftly and surely lead to the destruction of the secondary diode or transistor module.

Heat-transfer film

Replacement secondary diodes and transistor modules are supplied with a protective film covering this heat-transfer film. Before installing such new components, peel off the protective film first.

Heat dissipation from power componentry (continued)

Heat-transfer compound

To ensure optimum heat dissipation, there is a heat-transfer compound applied onto the underside of the secondary diode and transistor module.
After every separation of the secondary diode and transistor module from the heat sink, the heat-transfer compound must be renewed.

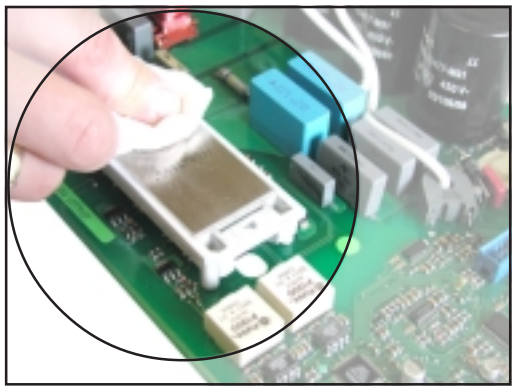

Fig.1

- Clean the underside of the transistor module with contact spray and a non-linting cloth

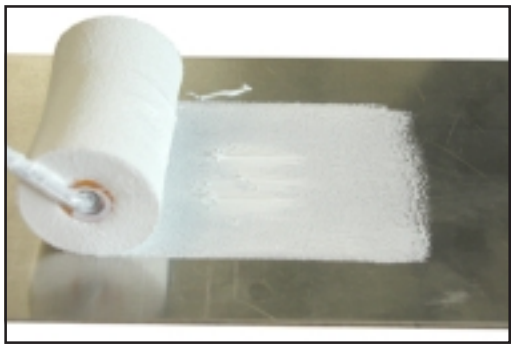

Fig.2

- Place a blob of heat-transfer compound on a flat, clean and smooth surface (e.g. coated wooden board)
- Using an application roller, spread the heat-transfer compound evenly across the surface
- Roll alternately from left to right until part of the surface is completely and evenly covered with heat-transfer compound

Fig.3

- Roll alternately at right angles to the previous direction until part of the surface is completely and evenly covered with heat-transfer compound
- Once there is an even, thin layer of compound on the roller of the application tool, lift the tool out of the compound

Heat dissipation from power componentry (continued)

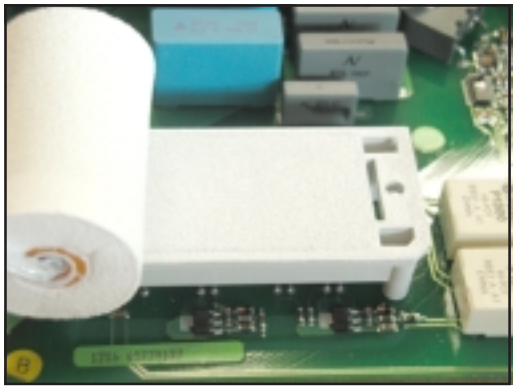

Abb.4

Note! If the heat-transfer compound is not applied to the component in a complete, gap-free layer, this may result in heat-transfer problems.

If too thick a layer of heat-transfer compound is applied, this also impairs heat transfer, and the transistor module may break when the fixing screws are tightened.

- Roll the compound approx. two or three times, until the underside of the transistor module is completely covered

Screwing the power component to the heat sink

The mounting surface of the power component must be clean and free of particles.

- Clean the mounting surface of the heat sink with contact spray and a non-linting cloth
- Use fine grinding paper (grain P500 or finer) to remove any contamination or unevenness on the mounting surface of the heat sink
- Clean the mounting surface of the heat sink with contact spray and a non-linting cloth again
- To begin with, only tighten the fixing screws very gently
- Before tightening the fixing screws, ensure that the power component is lying flat and without any gaps on the mounting surface

Note! When tightening the fixing screws, do not exceed a torque of 2.2 Nm. Tightening with more than 2.2 Nm can seriously damage the power component.

- Tighten the fixing screws with a torque of 2 Nm (max. 2.2 Nm)

General basics - packaging

Delivery

Only ship the TP 1500 power source in its original packaging.

The inside packaging consists of one supporting element at the underside of the power source, and one at the top. The outside packaging is a coated corrugated cardboard box with a carrying handle.

Electronic components and power components must always be packed in an ESD-compatible manner. The most suitable packaging for this is insulating material (plastic), which should completely enclose the packed component.

Note! Where several components are packed together, they must not be allowed to touch one another.

Each of the components inside the packaging must be wrapped separately in insulating material.

History

Modification No modifications have yet been made to the TP 1500 series.

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Measuring and testing equipment, tools

General remarks

Note! Observe the calibration intervals specified by your QM System for the measuring and testing equipment and tools that are used.

Measuring and test equipment

- **Oscilloscope**
- **Multimeter** with diode-testing function
- **Shunt** (measuring range: up to 180 A)
- **Power resistor** (160 mOhm / P > 3.14 kW)
- **Power resistor** (4 Ohm / P > 400 W)
- **Test unit for PE conductor test** (cross-sectional area of PE conductor: 1.5 mm²)
- **Test unit for insulation test**
- **Recommended: Measuring circuit for testing the open-circuit voltage** (see the section headed “Measuring, inspection and adjustment jobs”)

Tools and appliances

Designation

(1) Manual torque screwdriver 1 to 6 Nm
(2) Bit insert TX 20, for torque screwdriver
(3) Bit insert hexagon-socket, width-across 3, for torque screwdriver
(4) Molex extractor tool
(5) Grinding paper (grain P 500 or finer)
(6) Contact spray
(7) Socket spanner holder with 1/4’’ external hexagonal-socket drive and 1/4’’ external square-socket drive, to fit torque screwdriver
(8) Socket spanner insert - width-across 7 - with 1/4 ’’ internal square-socket drive

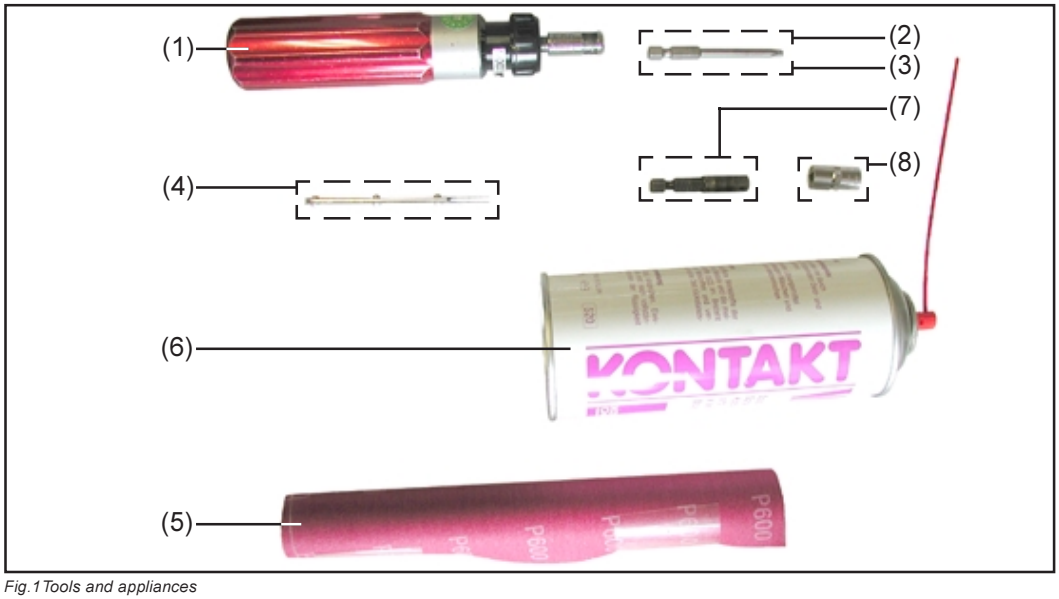

Fig.1 Tools and appliances

Additional needed tools

- Soldering iron
- Special solder for electronic applications
- Solder absorption strand
- Suction pump (as an alternative to the solder absorption strand)
- Heat-transfer compound
- Foamed plastic roller
- Round-nut spanner

Filter attachment

Filter attachment with filter insert

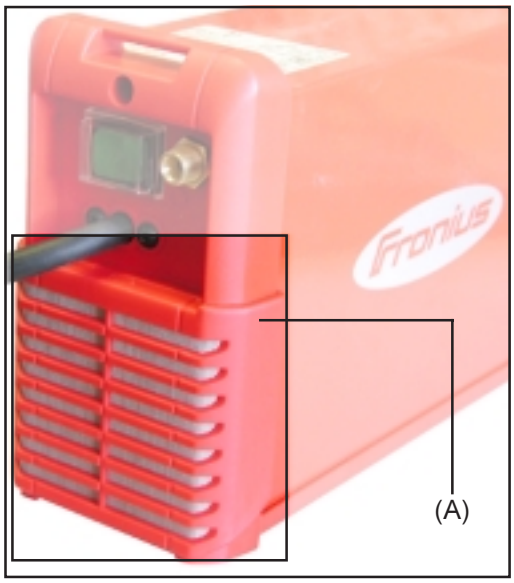

Fig.1

Particularly when intended for use in heavily dust-laden environments, the TP 1500 power source can be supplied with a filter attachment (A) (42,0405,0303). This removes the dust particles out of the cooling air sucked in by the fan.

- Mount the filter attachment over the air-intake slots, as shown in the picture below

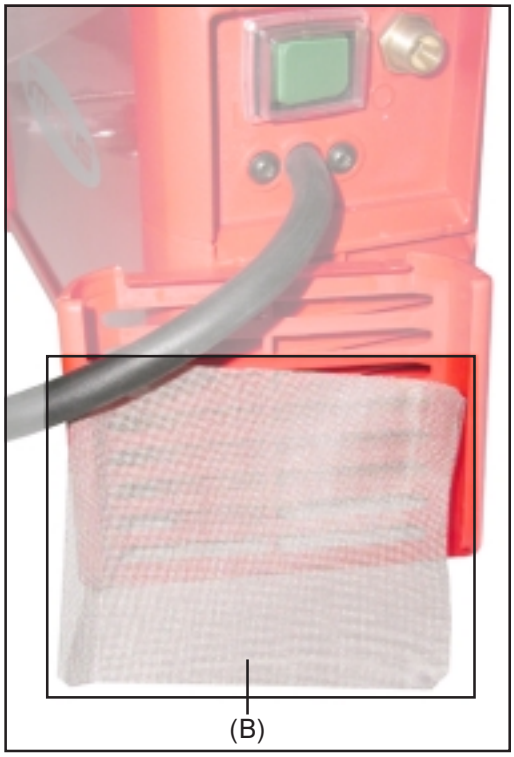

Fig.2

The filter attachment has an exchangeable filter insert B (42,0201,1095).

- Change the filter insert regularly, as necessitated by the rate of dust accumulation

Opening the housing

Opening the housing

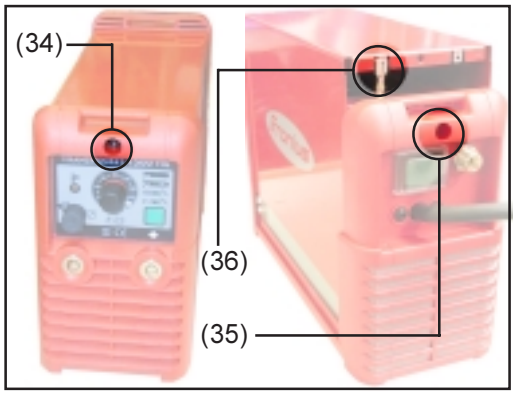

Fig.1

- Remove the carrying strap
- Undo the 5x25-TX20 screw (34) in the front of the housing
- Undo the 5x25-TX20 screw (35) in the rear of the housing
- Carefully lift the housing and unplug the “Housing earthing conductor” (36)

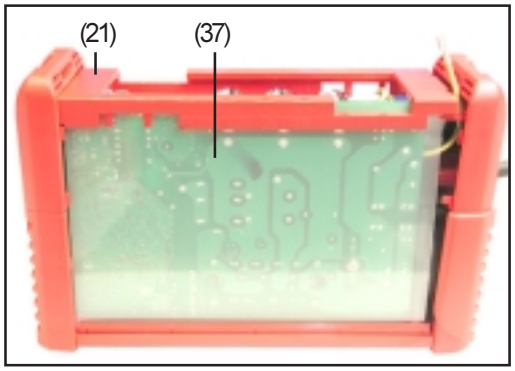

Fig.2

- Remove the housing stiffening reinforcement (21)
- Remove the p.c.-board insulator (37)

Care and maintenance

Regular checks and care

Warning! An electric shock can be fatal. Before opening up the welding machine, switch it off, unplug it from the mains and put up a warning sign to stop anybody switching it back on again. If necessary, discharge the electrolytic capacitors.

In order to keep the power source operational for years to come, you should observe the following points:

- Carry out safety inspections at the stipulated intervals (see the section headed “Safety rules”)
- Depending on the machine location, but no less often than twice a year, remove the housing and blow the inside of the power source clean with dry, oil-free, reduced-blow compressed air. Do not aim air-jets at electronic components from too close a range.
- If a lot of dust has accumulated, clean the cooling-air ducts.

Checking and setting the maximum welding amperage

Note! Whenever the LCA 15 board is replaced, it is necessary to check and set the maximum welding amperage (see the section headed “Measuring, inspection and adjustment jobs”).

Troubleshooting

Safety

Warning! An electric shock can be fatal. Before opening up the power source, switch it off, unplug it from the mains and put up a warning sign to stop anybody inadvertently switching it back on again. If necessary, discharge the electrolytic capacitors.

Troubleshooting table

Error	Cause	Remedy
No welding current Mains switch is ON, operational readiness indicator not lit up	Break in mains lead	Check mains lead and mains voltage
	Mains switch is faulty	Replace the mains switch (see the section headed “Installation instructions for rear of housing, mains switch and mains cable”)
No welding current Mains switch is ON, operational readiness indicator is lit up	Break in welding cable connection	Check plug-in connections
	Faulty or broken earth connection	Earth workpiece
No welding current Mains switch is ON, operational readiness indicator is lit up	LCA 15 malfunction / is faulty	Switch power source off, wait 10 seconds, and switch back on again. If fault recurs despite several tries - replace LCA 15 board (see the section “Installation instructions for LCA 15 board“)
No welding current Mains switch is ON, operational readiness indicator lights up, malfunction indicator flashes	Maximum duty cycle exceeded - machine overloaded	Observe duty cycle
	Thermostatic cut-out system has tripped - fan is running; temperature sensor is faulty	Wait until cooling down period is over; machine will switch on automatically - if not: machine should be serviced
	Insufficient cooling air reaching machine	Ensure sufficient supply of cooling air
	Dust filter is dirty	Remove the filter attachment and clean or change filter insert
	Power module is very dirty (e.g. Operation without filter atachmnet)	Remove cover of power source and blow inside of machine clean with dry, oil-free, reduced-blow compressed air (see “Care and Maintenance”)
No welding current Mains switch is ON, operational readiness indicator lights up, malfunction indicator flashes	Fault in power section	Switch power source off, wait 10 seconds, and switch back on again. If fault recurs despite several tries - check power source
Also: visible damage to the transformer (transformer cables are charred)	Transformer is faulty	Exchange the transformer (see “Installation instructions for transformer”)

Troubleshooting table
(continued)

Error	Cause	Remedy
No welding current After the machine is switched on, all indicators are permanently lit up (longer than 2 seconds)	Short-circuit (secondary side)	Stop the short circuit (unplug the electrode or earth cable from the bayonet socket). If the fault persists: Open up the housing and check all cables for insulation damage, and that no bare conductors are touching any parts of the housing or each other.
LEDs on LCA 15 board at selected process „rod-electrode welding“: “ISOLL” is dark (LED brightness depends on the pre-set welding amperage)	Potentiometer is faulty	Exchange the FPA 15 board (see “Installation instructions for FPA 15 board“)
	Ribbon cable for FPA 15 board is faulty	Exchange the LCA 15 board (see “Installation instructions for LCA 15 board“); Then check and set the maximum welding amperage (see “Checking and setting the maximum welding amperage”)
“SUPP” is lit up	Incorrect supply voltage	Run the power source on the correct mains voltage
		If “SUPP” is still lit up: Check the cables and plug-on connections on the LCA 15 board; inspect the shunt cables.
		If “SUPP” is still lit up: Replace the LCA15 board (see “Installation instructions for LCA 15 board”). Then check and set the maximum welding amperage (see “Checking and setting the maximum welding amperage”).
Malfunction indicator on the operating panel of the power source flashes	LCA 15 board is faulty	Replace the LCA15 board (see “Installation instructions for LCA 15 board”). Then check and set the maximum welding amperage (see “Checking and setting the maximum welding amperage”).
	Secondary diode is faulty	Replace the secondary diode (see “Installation instructions for LCG 15 board
	LCG11 board is faulty	Replace LCG15 board (see “Installation instructions for LCG 15 board and sec. diode”)
	Welding-voltage measurement is faulty (no signal on the 10-pole Molex plug X10, Pin 3)	Check cables and plug-on connections. If nec., replace LCG15 board (see “Installation instructions for LCG 15 board and sec. diode”)
Malfunction indicator on the operating panel of the power source is lit up Specified duty cycle is not being reached - Fan is running	Heat-sink is dirty	Blow the heat-sink clean with dry, oil-free compressed air
	Temperature sensor is faulty	Replace temperature sensor (see “Installation instructions for temperature sensor”)
Fan is not running	Fan is faulty	Replace fan (see “Installation instructions for fan”)

Troubleshooting table
(continued)

Error	Cause	Remedy
	LCA 15 board is faulty	Replace the LCA 15 board (see "Installation instructions for LCA 15 board")
Not possible to set welding current on (otherwise fully functional) AL 1500 torch or TR 1500 remote control unit	Remote-control unit socket is faulty (TP 1500 RC and TP 1500 TIG)	Replace the remote-control unit socket on the FPA 15 board (see installation instructions "Replacing the remote-control unit socket")
TP 1500 TIG: No gas-flow when "TIG welding" or "TIG pulsed-arc welding" modes are selected **N.B.!** Activate the "Gas test" function as follows: - Shift the mains switch into the "O" position - Press the "Process" button at the same time as you shift the mains switch to the "I" position	Sieve on gas solenoid valve is dislocated - even when the "Gas test" function is activated, there is still 15 V on the (white) "Gas value" cables to the gas solenoid valve	Take the pressure regulator out of the gas connection. Aim a jet of dry, reduced-blow compressed air into the welding socket (-) for several seconds
	Gas solenoid valve is faulty - even when the "Gas test" function is activated, there is still 15 V on the (white) "Gas value" cables to the gas solenoid valve	Replace the gas solenoid valve (see the section headed "Installation instructions for gas solenoid valve")
	LCA 15 board is faulty - even when the "Gas test" function is activated, only 0 V (instead of 15 V) is measured on the "Gas value" cables to the g.s.v.	Replace LCA 15 board (see the section headed "Installation instructions for LCA 15 board")
It is not possible to set the welding amperage correctly using the setting dial The actual welding amperage very obviously does not correspond to the pre-set welding amperage	Cables and plug-on connections on LCA 15 or FPA 15 board are loose or faulty	Check the cables and plug-on connections on the FPA 15 and LCA 15 board
	Shunt cables are loose or faulty	Check the shunt cables
	Maximum welding amperage is incorrectly set	Check and set max. welding amperage (see "Checking and setting the maximum welding amperage")
	Potentiometer is faulty	Replace the FPA 15 (see "Installation instructions for welding-current dial")
Arc sometimes breaks during the welding process	If the TIG welding process is selected, the TIG comfort-stop parameter is set to too low a value	In the set-up menu, set the TIG comfort-stop parameter to a higher value
	Arc-drop voltage of electrode too high (e.g. grooved electrode)	If possible, use different type of electrode or a machine capable of delivering greater welding current
	Mains undervoltage	Measure mains voltage at mains connection, use a supply cable with a bigger cross-sectional area
	Wrong process has been selected for the present welding operation	Select a process that is suitable for the welding operation being performed
Rod electrode tends to stick (in rod-electrode welding)	The parameters "Arc force" (in rod-electrode welding) or "Characteristic" (in rod-electrode welding using CEL-electrodes) are set to excessively low values	In the Set-up menu, set the "Arc force" or "Characteristic" parameter to a higher value

Troubleshooting table
(continued)

Error	Cause	Remedy
Poor ignition characteristics (Rod-electrode welding)	Wrong welding process selected	Select the welding process "Rod-electrode welding" or "Rod-electrode welding with CEL-electrode"
Poor ignition characteristics (TIG-welding)	Wrong welding process selected	Select the "TIG welding" or "TIG pulsed arc welding" process (TP 1500 TIG)
	TP 1500 TIG: Automatic gas flow does not start up	Gas solenoid valve or LCA 15 board is faulty. See “TP 1500 TIG: No gas flow”
	Tungsten electrode is dirty or tip is damaged	Resharpen the tungsten electrode
	An unalloyed tungsten electrode (colour-coded green) is being used	Use another type of tungsten electrode
	Welding torch is damaged: Torch body, protective hose etc. are defective	Change the damaged parts or replace the whole torch
Mains fuse and/or safety cut-out has tripped	Mains fuse too weak; incorrect safety cut-out	Insert correct fuse (see technical data - rating plate“)
	Mains fuse is tripped under no-load conditions	Power source should be serviced
Loud bang in some cases the mains fuse or automatic circuit-breaker is tripped as well	Varistor (overvoltage protector) has been tripped; mains voltage error	Replace the varistor (See “Installation instructions for varistor”)
Poor welding characteristic (high degree of spattering)	Incorrect electrode polarity	Reverse polarity - Note manufacturer’s instructions
	Poor earth connection	Fix earth clamp directly on to the work-piece
	Unfavourable set-up settings for the selected welding process	In the set-up menu, optimise the settings for the selected welding process
TIG welding Tungsten electrode melts off; tungsten inclusions in the base metal during ignition	Incorrect electrode polarity	Connect TIG welding torch to "- pole"
	Wrong shielding gas, no shielding gas	Use inert shielding gas (argon)
	Wrong welding process selected	Select the "TIG welding" or "TIG pulsed arc welding" process

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Measuring, inspection and adjustment jobs - Checking and setting the parameters on the welding sockets

General remarks

Note! Whenever the LCA 15 board is exchanged, it is necessary to check and set the maximum welding amperage.

Checking the maximum welding amperage and Hot-Start

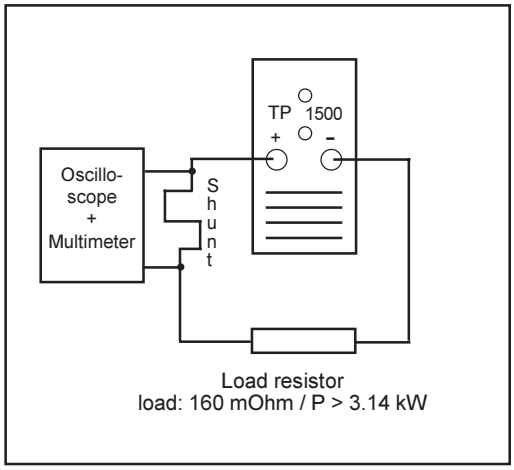

Fig.1 Checking the maximum welding amperage

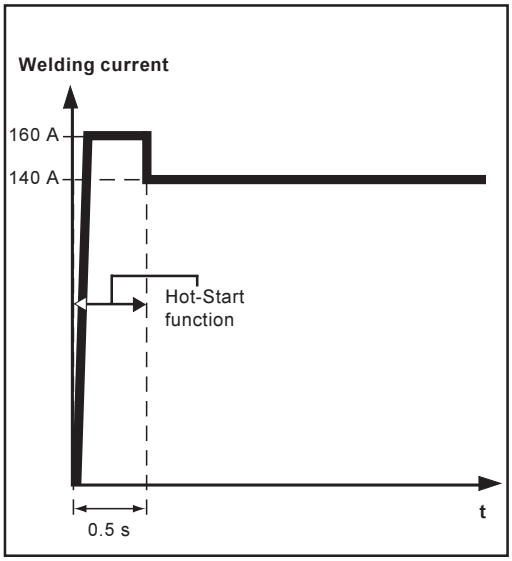

Fig.2 Hot-Start

- Shift the mains switch to the “O” position and unplug the machine from the mains
- Connect the shunt and power resistor to the welding sockets of the power source
- Set the welding current dial to Maximum
- Plug the machine back into the mains and shift the mains switch to the “I” position
- Select the welding process “rod electrode welding”
- Measure the welding current using the shunt and power resistor
- For a 0.5 sec period, the welding current must rise to 160 A = Hot-Start-current
- $I_{Hotstart}$ = 160 A
  - Tolerance range = +/-5 A
- Following the welding current must decrease to constantly 140 A = maximum welding current
- I_{max} = 140 A
  - Tolerance range = +/-5 A

If $I_{Hotstart}$ and I_{max} are not within the tolerance range, this may mean that the LCA15 board or the potentiometer are faulty,

- or that I_{max} is not set correctly.

If the maximum welding current (I_{max}) is too high or too low, set the maximum welding current.

Setting the maximum welding amperage

- Shift the mains switch to the “O” position and unplug the machine from the mains
- Connect the shunt and the power resistor to the welding sockets of the power source
- Set the welding-current dial to Maximum

Warnung! An electric shock can be fatal. This test is performed with the power source switched on and the housing opened up. As long as the power source is plugged into the mains, do NOT under any circumstances touch the power source or any of its components. Follow these instructions even after unplugging the power source from the mains. The capacitors are still charged - and still very dangerous!

Setting the maximum welding amperage (continued)

- Open the housing (see the section headed: “Opening the housing”)
- Plug the machine into the mains and shift the mains switch to the “I” position
- Select the welding process “rod-electrode welding“
- Measure the max. welding current using the shunt and power resistor
- Adjust the potentiometer (1) - Fig.3 - on the LCA15 board, until the exact value for the maximum welding current (140 A) is reached
- I_{max} = 140 A

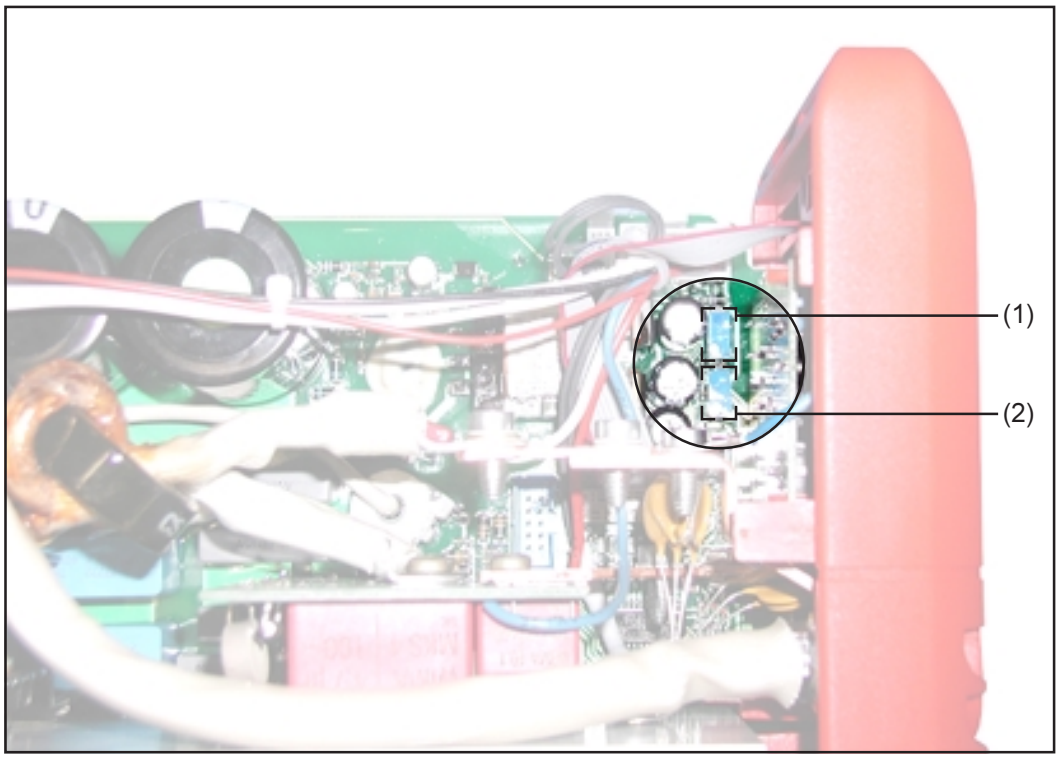

Fig.3 Potentiometer for setting the maximum welding amperage

Checking the minimum welding amperage

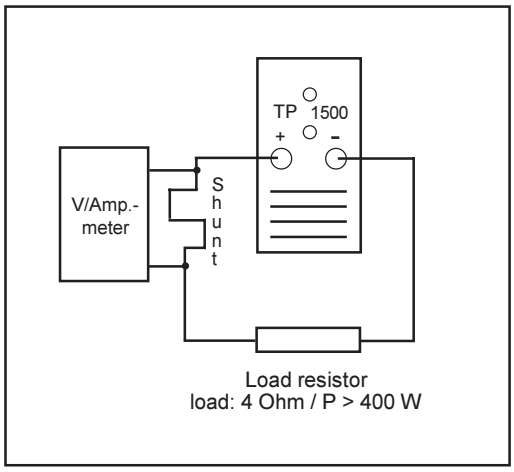

Fig.4 Checking the minimum welding amperage

- Shift the mains switch to the “O” position and unplug the machine from the mains
- Connect the shunt and power resistor to the welding sockets of the power source
- Set the welding-current dial to Minimum
- Plug the machine back into the mains and shift the mains switch to the “I” position
- Select the welding process “rod-electrode welding“
- Measure the min. welding current using the shunt and power resistor
- I_{min} = 10 A
  - Tolerance range = +/-1 A

If I_{min} is not within the tolerance range, this may mean that the LCA15 board or the potentiometer are faulty

- or that I_{min} is not set correctly.

If the minimum welding current (I_{min}) is too high or too low, set the minimum welding current.

Checking the minimum welding amperage (continued)

- Shift the mains switch to the “O” position and unplug the machine from the mains
- Connect the shunt and power resistor to the welding sockets of the power source
- Set the welding-current dial to Minimum

Warnung! An electric shock can be fatal. This test is performed with the power source switched on and the housing opened up. As long as the power source is plugged into the mains, do NOT under any circumstances touch the power source or any of its components. Follow these instructions even after unplugging the power source from the mains. The capacitors are still charged - and still very dangerous!

Open the housing (see the section headed: “Opening the housing”)

- Plug the machine into the mains and shift the mains switch to the “I” position
- Select the welding process “rod-electrode welding“
- Measure the minimum welding current using the shunt and power resistor
- Adjust the potentiometer (2) - Fig.3 - on the LCA15 board, until the exact value for the maximum welding current (10 A) is reached
- I_{min} = 10 A

Checking the open-circuit voltage

It is recommended to measure the open-circuit voltage as a peak value. For taking this measurement, use the specially designed measuring circuit.

In the drawing, the measuring circuit can be found beneath the heading “Variant 1: Measuring the peak value using the measuring circuit”.

Alternatively, if the measuring circuit is no longer available, the RMS value can be measured.

Note! The RMS value can only be of any help in detecting a defect in the power source in the event of very severe deviations from the desired value.

Variant 1: Measuring the peak value using the measuring circuit

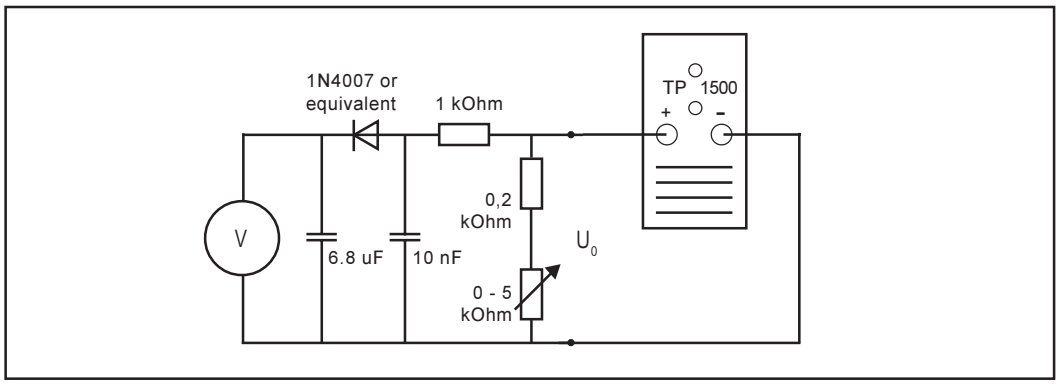

Fig.5 Checking the open-circuit voltage - Variant 1: Measuring the peak value using the measuring circuit

- Set up the measuring circuit as shown in the illustration above
- Shift the mains switch to “O” and unplug the machine from the mains
- Connect the measuring circuit, together with the voltmeter, to the welding sockets
- Plug the machine back into the mains and shift the mains switch to “I”
- Set the welding-current dial to Maximum
- Select the welding process “rod-electrode welding“
- Peak value of open-circuit voltage = approx. 92 V_{DC}
  - Tolerance range = +/-10V_{DC} if the variable resistor of the measuring circuit is set to 5 kOhm

If the open-circuit voltage is not within the tolerance range, this may mean that the LCA15 board or the potentiometer are faulty.

Checking the open-circuit voltage (continued)

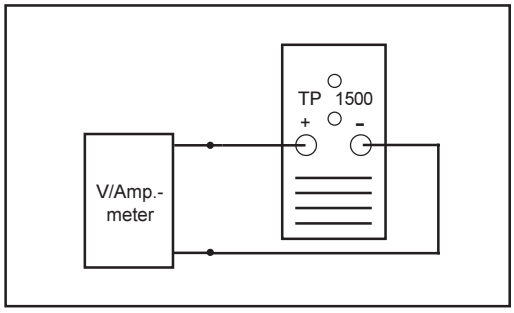

Fig.6 Variant 2: Measuring the RMS value

Variant 2: Measuring the RMS value

N.B.! The RMS value can only be of any help in detecting a defect in the power source in the event of very severe deviations from the desired value.

- Plug the machine into the mains and shift the mains switch to “I”
- Set the welding-current dial to Maximum

- Measure the open-circuit voltage with the voltmeter
- RMS value of the open-circuit voltage = approx.. 80 V_{DC}
  - Tolerance range = +/-15 V_{DC}

If the open-circuit voltage is not within the tolerance range, this may mean that the LCA15 board or the potentiometer are faulty.

Checking the open-circuit voltage - TP 1500 VRD

The open-circuit voltage check procedure described as follows applies to power sources TP 1500 VRD und TP 1500 TIG VRD.

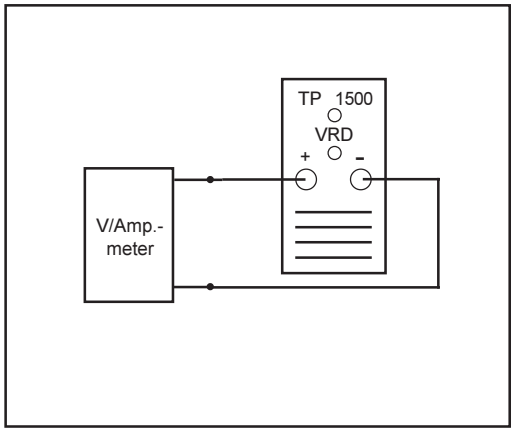

Fig.6a TP 1500 VRD: Measuring the open-circuit voltage

Use a multimeter to check the open-circuit voltage.

- Plug the machine into the mains and shift the mains switch to „I“
- Measure the open-circuit voltage with the multimeter.
- Open-circuit voltage = ca. 10,5 - 12 V_{DC}

If the value measured is below 10,5 V_{DC}, this may mean that the VRD15 board is faulty.

Check the arc-force and anti-stick

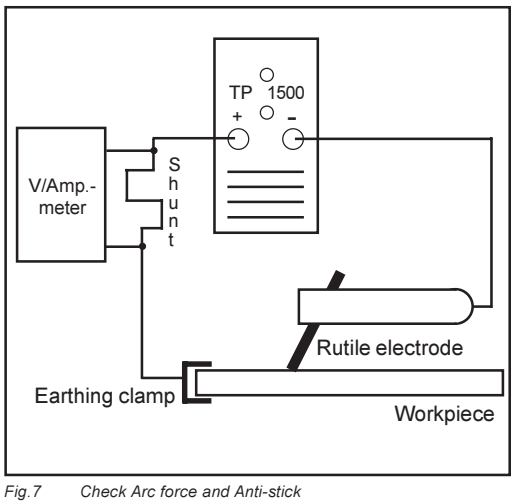

Fig.7 Check Arc force and Anti-stick

- Shift the mains switch to “O” and unplug the machine from the mains
- Plug the welding cable with the rutile electrode onto the (-) socket
- Plug the earthing cable with the shunt onto the (+) socket
- Set the welding-current dial to Maximum
- Plug the machine into the mains and shift the mains switch to “I”
- Select the welding process “rod-electrode welding“
- Set the parameter "Arc force" within the set-up menu to the maximum value which is possible

Check the arc-force and anti-stick
(continued)

Warning! Work performed incorrectly can cause serious injury and damage. Observe all safety measures and protective precautions for welding, as set out in the “Safety rules” section of the power source operating instructions.

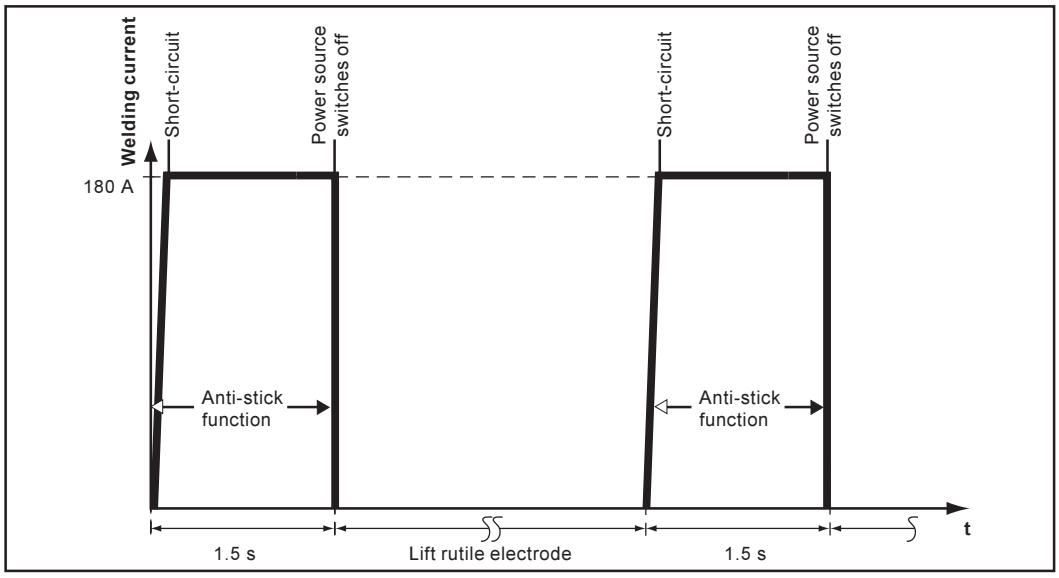

Fig.8 Checking “Arc force” and “Anti-stick” - test procedure

- Touch the workpiece with the rutile electrode
- **Condition 1:** The welding current briefly jumps to around 180 A (arc force)
- **Condition 2:** After approx. 5 seconds the welding current automatically switches off (anti-stick function)
- Lift the rutile electrode off the workpiece
- **Condition 3:** Power source is ready for welding

If any of the above conditions were not fulfilled, this may mean that the LCA15 board is faulty.

Cycle test

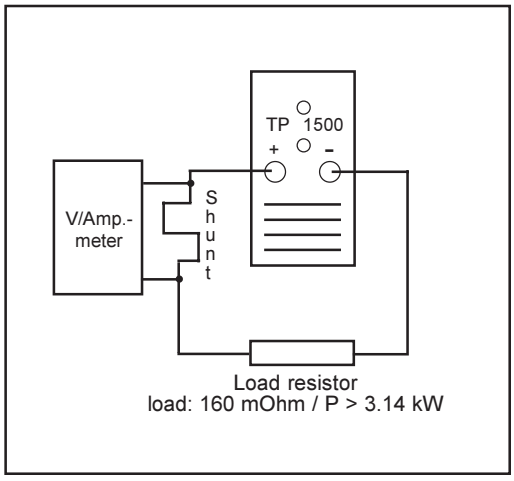

Fig.9 Cycle test

- Shift the mains switch to “O” and unplug the machine from the mains
- Connect the shunt and power resistor to the welding sockets of the power source
- Set the welding-current dial to Maximum
- Plug the machine into the mains and shift the mains switch to “I”
- Select the welding process “rod-electrode welding“

Note! The times given below are for an ambient temperature of approx. 25 °C.

Cycle test
(continued)

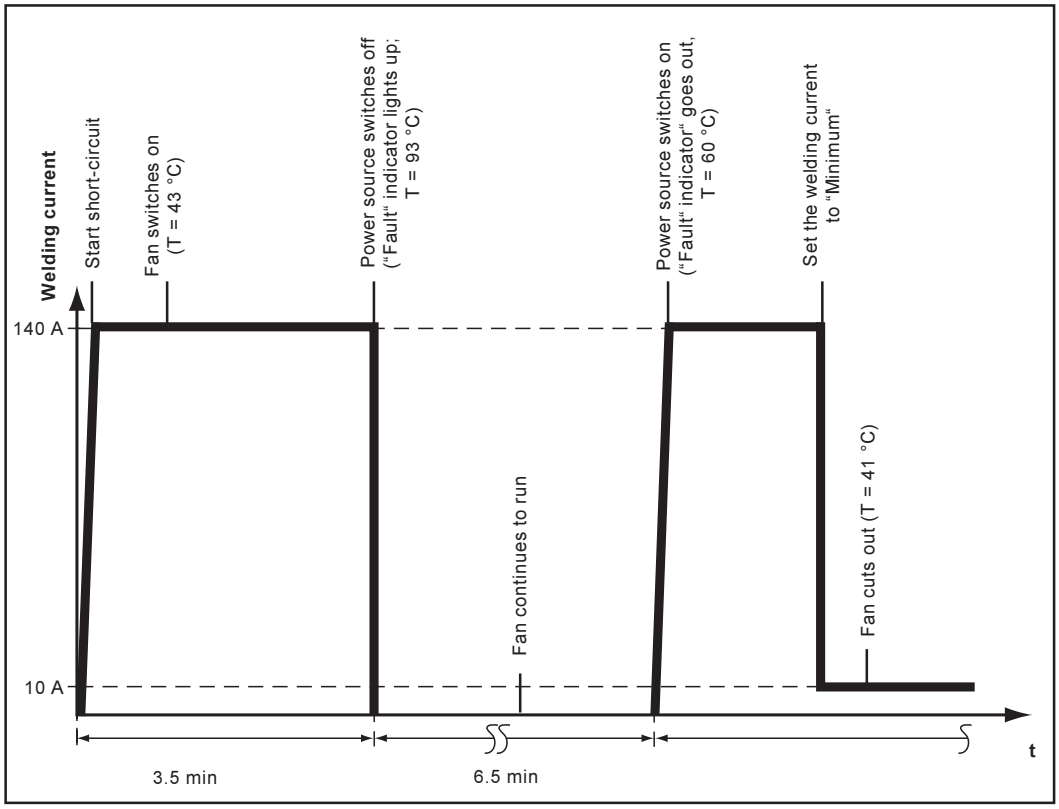

Fig.10 Cycle test - test procedure

- **Condition 1:** After several seconds, the fan switches on, and the heat-sink warms up to 43 °C
- **Condition 2:** Approx. three and a half minutes after being switched on, the power source switches off once the heat-sink has heated up to 93 °C
  - **Condition 3:** The fan must continue to run
  - **Condition 4:** The "Fault" indicator lights up
- **Condition 5:** After approx. six and a half minutes, the power source automatically switches back on once the heat-sink has cooled down to 60 °C
  - **Condition 6:** The "Fault" indicator goes out

- Set the welding-current dial to Minimum

- After a few more minutes, the fan cuts out once the heat-sink has cooled to a temperature of 41 °C

Checking the transistor module

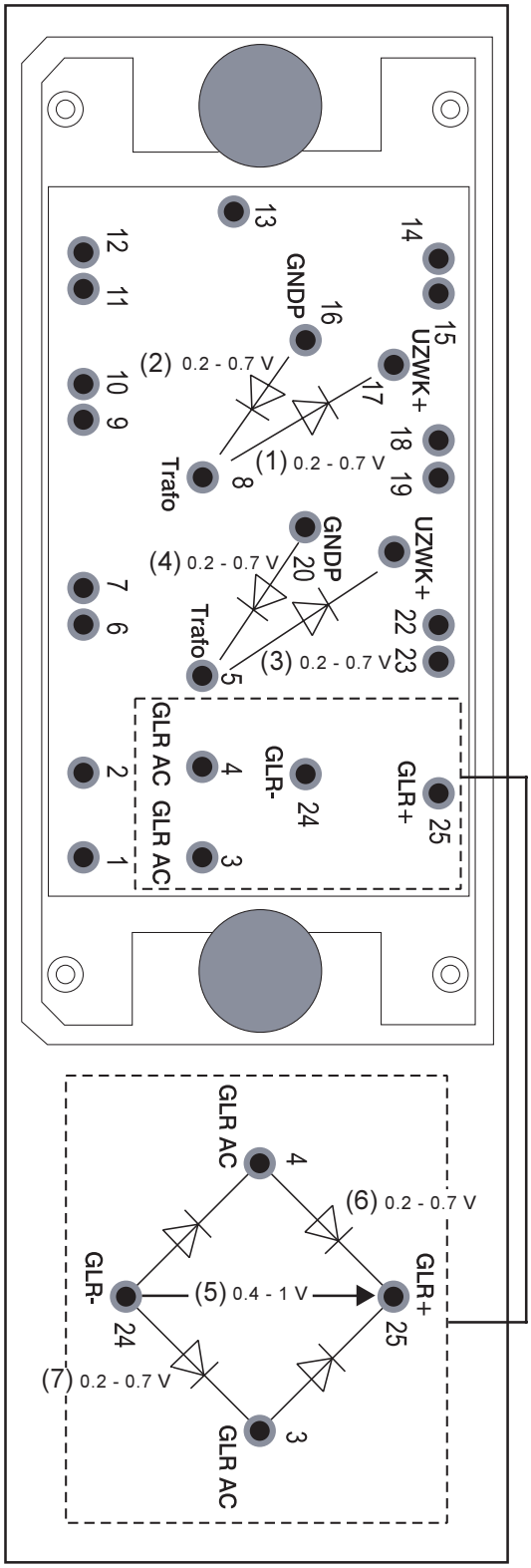

Fig.11 Transistor module with diode paths

- Shift the mains switch to “O” and unplug the machine from the mains

Warning! An electric shock can be fatal. Before beginning with the test procedure, discharge all the electrolytic capacitors.

- Open the housing (see section headed “Opening the housing”)
- Measure the diode paths in the conducting direction, as shown in the illustration, with a diode testing device (e.g. multimeter with diode testing function)
- Measure the diode paths in the non-conducting direction as well
- Replace the transistor module if the measurements in the conducting direction show that:
  - the measured voltage drop is significantly outside the specified tolerance ranges, or if:
  - a short-circuit or high-resistance continuity is measured
- Also replace the transistor module if a short-circuit or high-resistance continuity is measured in the non-conducting direction

The illustration (Fig.11) shows the diode paths of the transistor module and the respective diode voltages.

Checking the Transistor module
(continued)

Note! The following pictures show measurements being made in the conducting direction of the diode path.

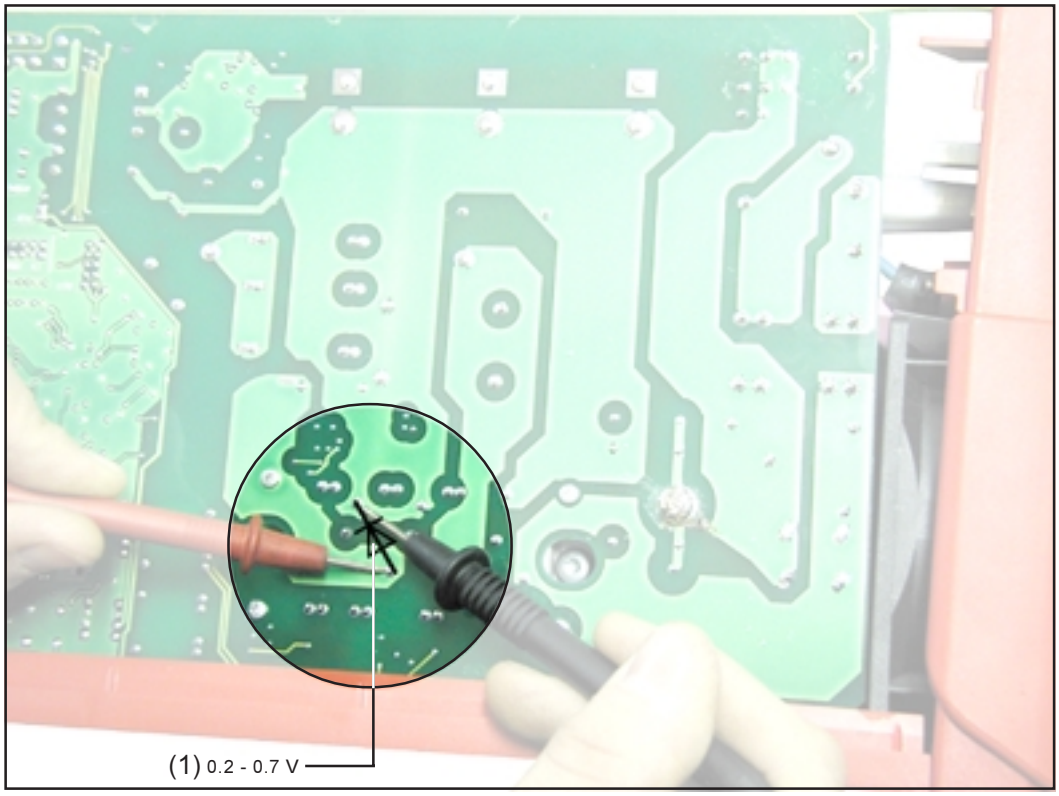

Fig.12 First diode path: "Intermediate-circuit potential - primary-side transformer cable"

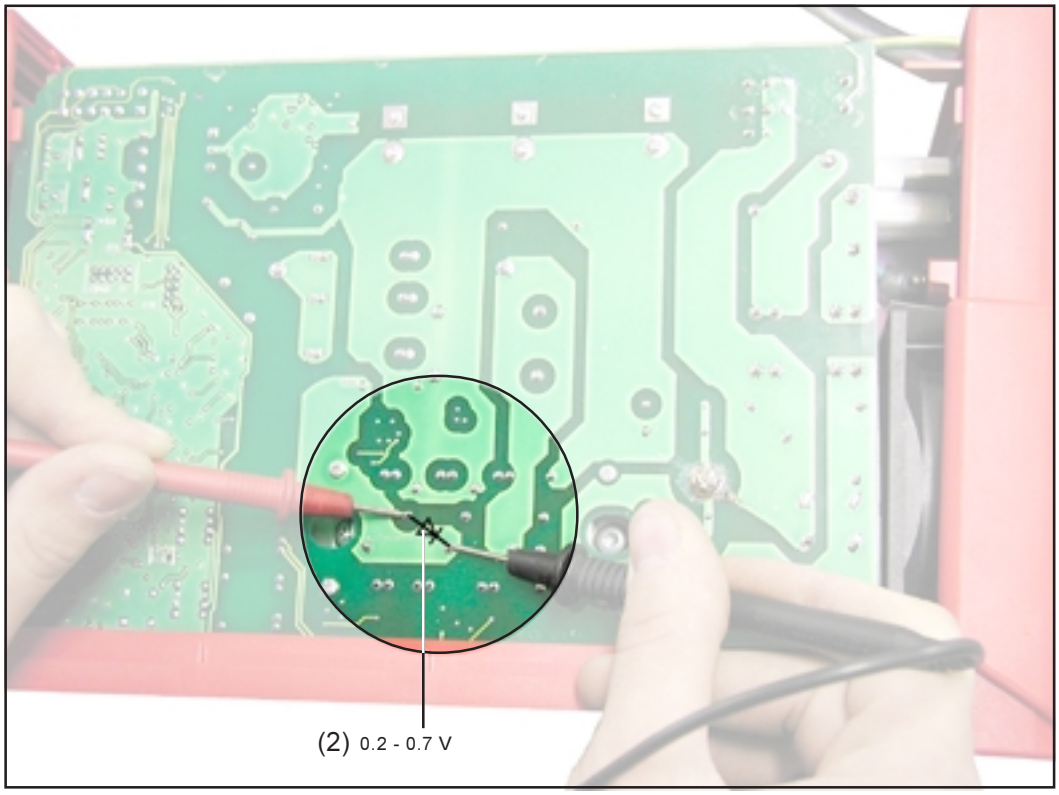

Fig.13 First diode path: "GND potential - primary-side transformer cable"

Checking the transistor module
(continued)

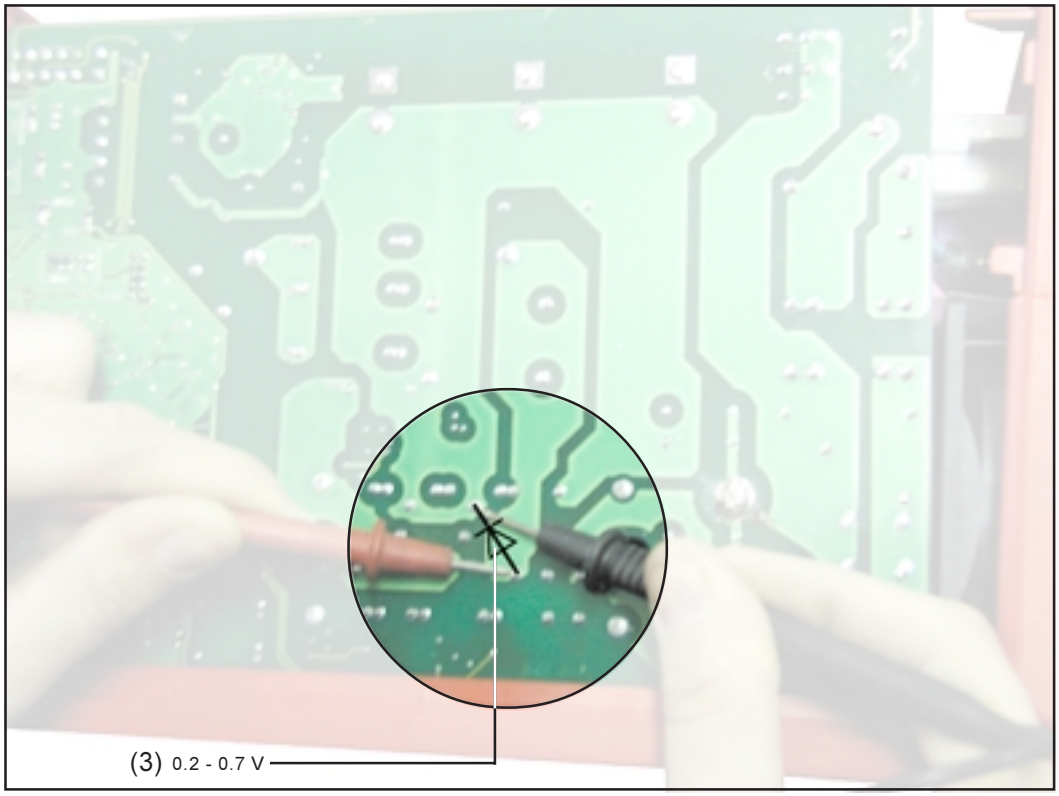

Fig.14 Second diode path: "Intermediate-circuit potential - primary-side transformer cable"

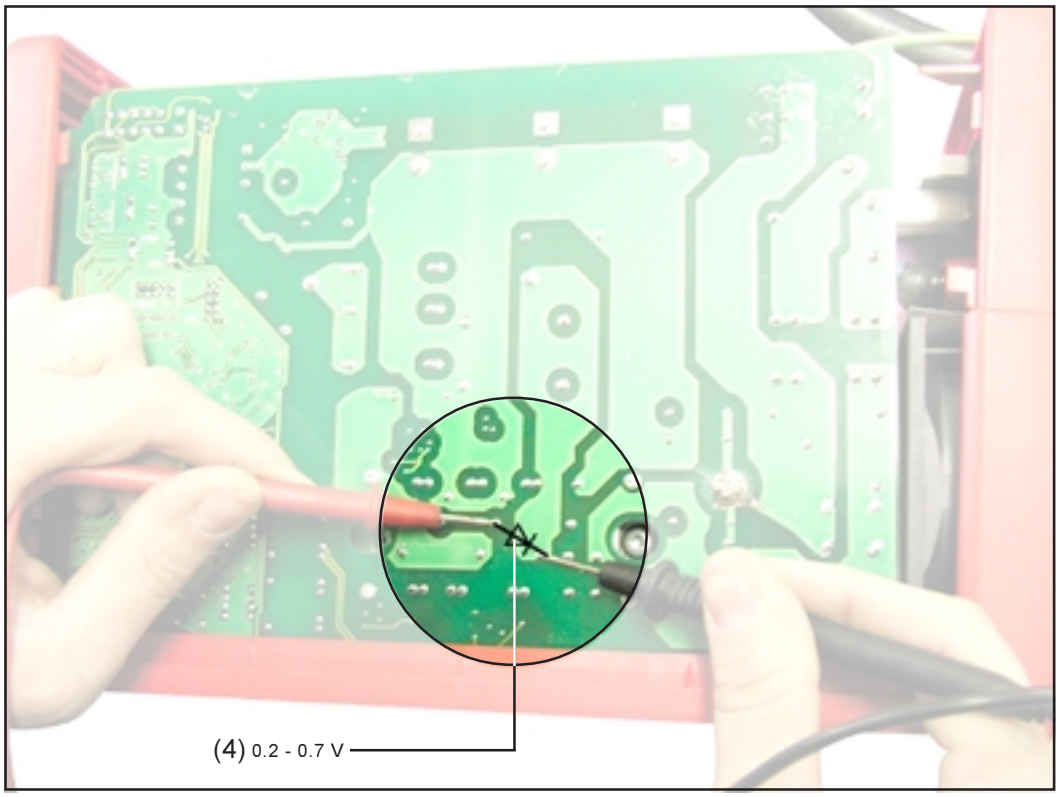

Fig.15 Second diode path: "GND potential -> primary-side transformer cable"

Checking the transistor module
(continued)

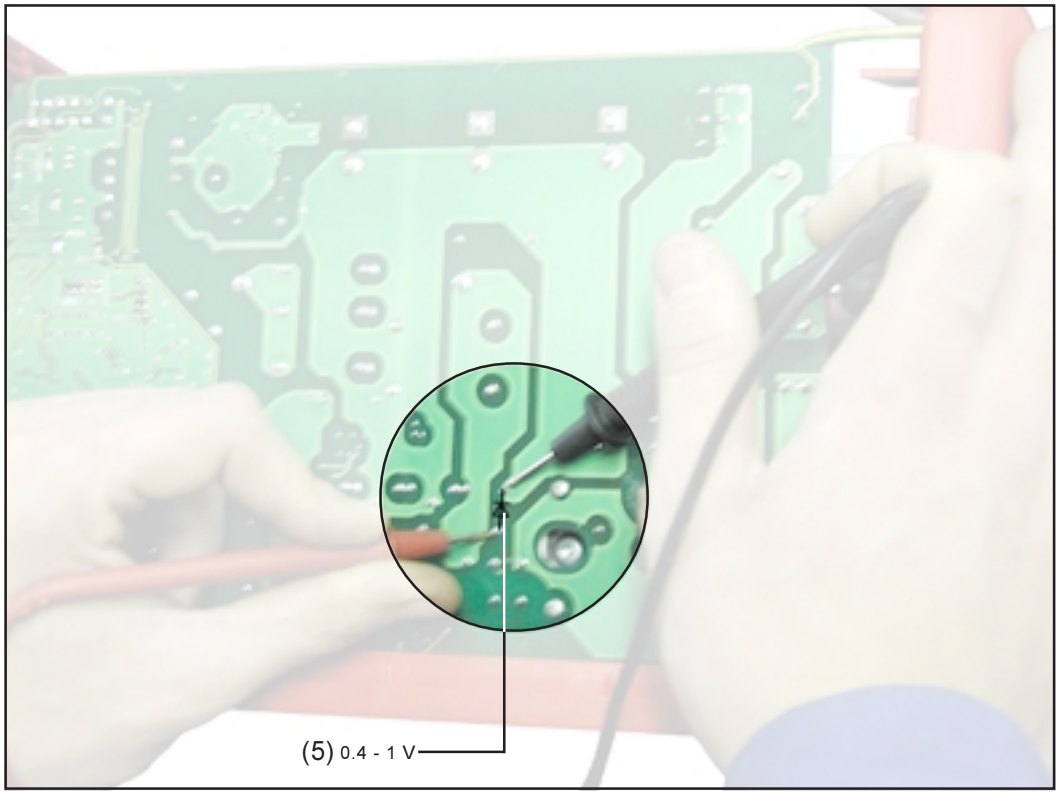

Fig.16 Diode path: "Rectifier ⊖ - rectifier ⊕

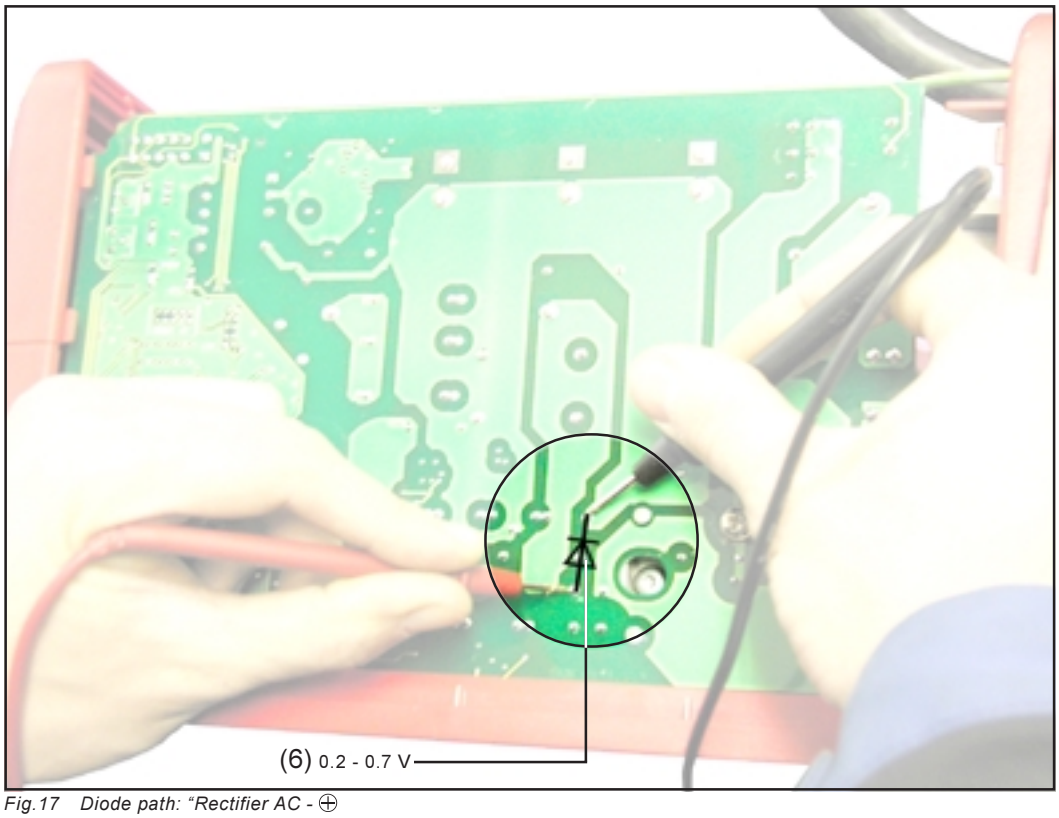

Fig.17 Diode path: "Rectifier AC - ⊕

Checking the transistor module (continued)

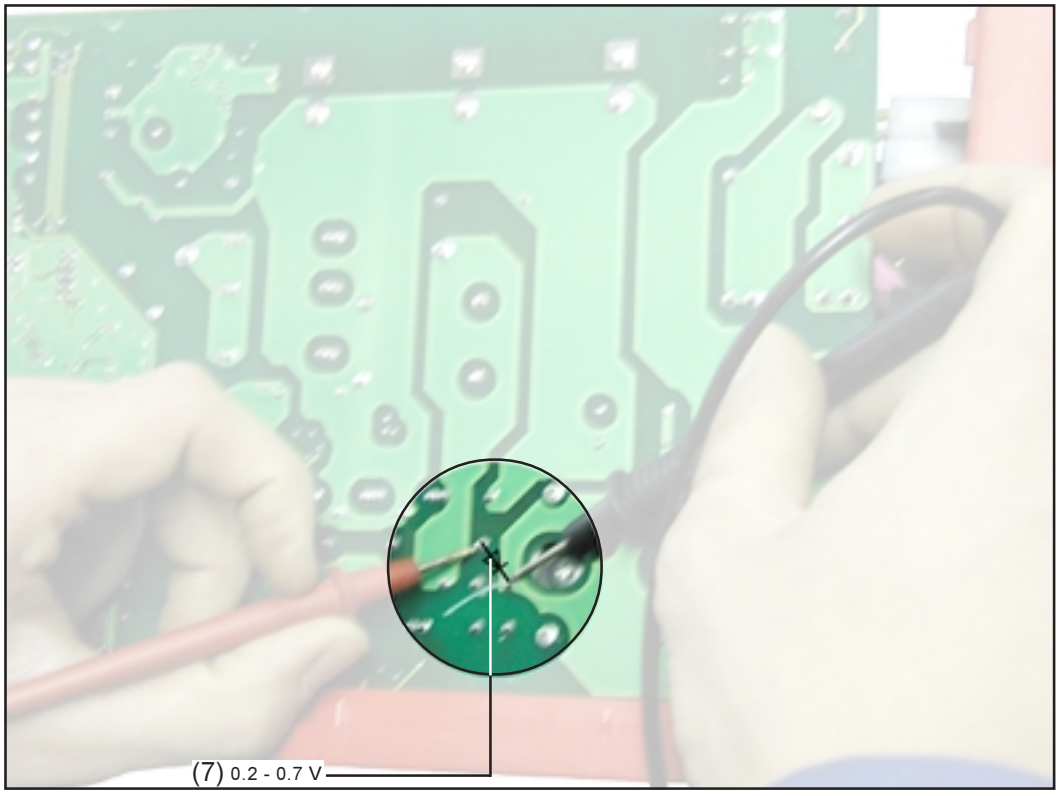

Fig.18 Diode path: “Rectifier AC ⊖

Checking the secondary diode

- Open the housing (see the section headed: “Opening the housing”)

Warning! An electric shock can be fatal. Before beginning with the test procedure, discharge all the electrolytic capacitors.

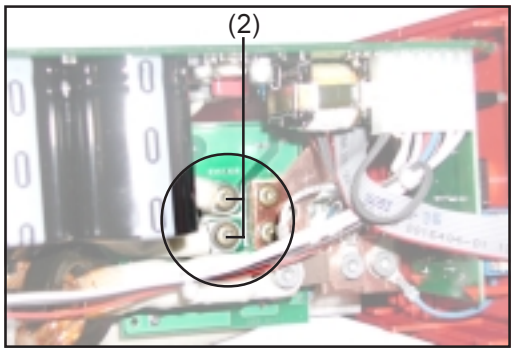

Fig.19 Detach transformer cables from the secondary diode

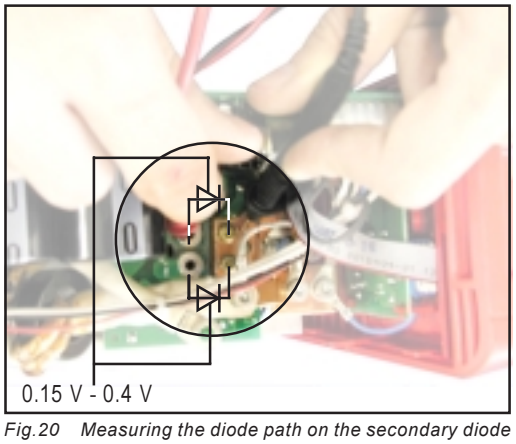

Fig.20 Measuring the diode path on the secondary diode

- Detach both transformer cables from the secondary diode:
  - undo the M4x20 (TX20) screws (2) with cup springs (Fig.19)
  - remove the screws (2) with cup springs

Important! The secondary diode has two parallel diode paths.

- Measure the diode paths in the conducting direction (Fig 20), with a diode testing device (e.g. multimeter with diode testing function)
- Measure the diode paths in the non-conducting direction as well
- Replace the secondary diode if the measurements in the conducting direction show that:
  - the measured voltage drop is significantly outside the specified tolerance ranges, or if:
  - a short-circuit or high-resistance continuity is measured
- Also replace the secondary diode if a short-circuit or low-resistance continuity is measured in the non-conducting direction

Checking the secondary diode (continued)

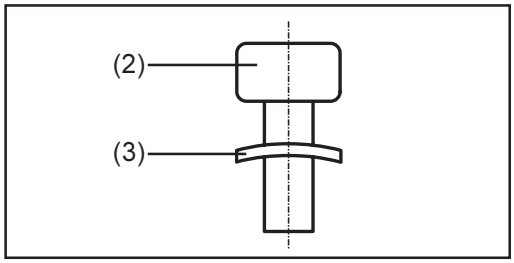

Fig.21 Fitting the cup springs

Before closing the housing:
- mount the screws (2) with cup springs (Fig.21)

Note! When mounting the cup springs (3), make sure that they are fitted in the correct position (Fig.21)

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Checking the potentiometer ribbon cable

Warning! An elelectric shock can be fatal. This check is performed with the machine switched on and the housing opened up. As long as the machine is plugged into the mains, do NOT under any circumstance touch the power source or any of its components.

Follow these instructions even after unplugging the machine from the mains. The capacitors are still charged - and still very dangerous!

- Open the housing (see the section headed: “Opening the housing”)

On the LCA15 board you will find the LED “I_{soll}” (in English, would be “I_{des}”). The brightness of this LED “I_{soll}” depends on the pre-set (i.e. “***des***ired”) welding amperage.
- Set the welding-current dial to “Minimum”
- Plug the machine into the mains and shift the mains switch to “I”
- Slowly turn the welding-current dial towards Maximum.
  - While doing this, watch LED “I_{soll}” all the time
- LED “I_{soll}” gets continuously brighter
  - Potentiometer is OK
- LED “I_{soll}” glows constantly
  - Potentiometer has a short circuit / LCA15 board is faulty
  - Replace potentiometer or LCA15 board
- LED “I_{soll}” remains dark
  - Potentiometer has an interruption / there is a break in the ribbon cable for the FPA11 board / the LCA15 board is faulty

Important! The FPA15 board with ribbon cable belongs to the LCA15 board assembly.

- Replace the potentiometer, LCA 15 board or the FPA15 board

PE conductor test

Fig.22 Testing the PE conductor

PE conductor test
(continued)

Important! Special testing equipment is needed for testing the PE conductor.

- Cross-sectional area of PE conductor: 1.5 mm²
- Adjust the PE-conductor testing unit to work with this cross-sectional area
  - Test current = 10 A
- Place the test-prod of the PE-conductor testing unit up against the front fixing screw and hold it there, as shown in Fig. 22
- Press and hold the “Test” button of the PE-conductor testing unit until the unit gives a confirmatory signal
  - Permissible voltage drop at 10 A < 2.6 V
  - Permissible PE-conductor resistance < 2.6 V / 10 A < 260 mOhm
- If the testing unit does not give any confirmatory signal, the PE conductor is faulty
- Check how the PE conductor has been installed inside the housing
  - Where necessary, re-install the PE conductor inside the housing
- Mains cable is faulty
  - Where necessary, replace the mains cable

Insulation test

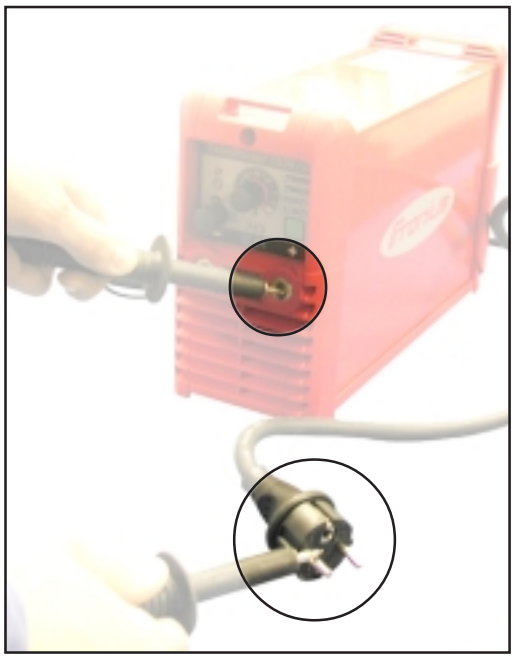


*Fig.23 Insulation test - **Primary circuit / secondary circuit***

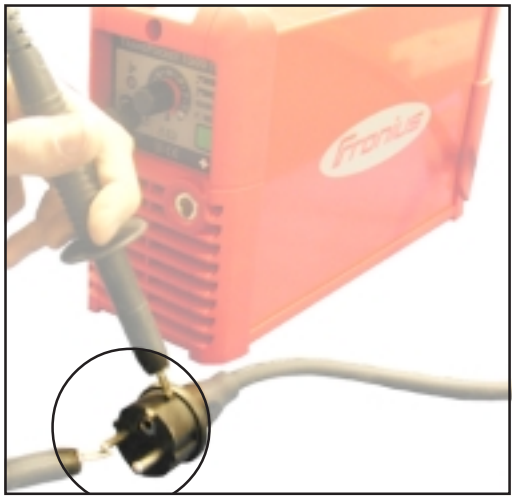


*Fig.24 Insulation test - **Primary circuit / earth***

Important! A suitable measuring unit is needed for the insulation test.

Warning! An electric shock can be fatal. The testing unit works with high voltage. Never touch the test-prods!

The test voltage of the testing unit is approx. 2.5 kV.

1st test: Primary circuit / secondary circuit

- Place a test-prod against one of the contacts of the mains plug (Fig.23)
- Place the second test-prod against one of the welding sockets (e.g. (+) socket) (Fig.23)
- Carry out the measurement
  - Insulation resistance must be > 5 MOhm

If the insulation resistance is less than 5 MOhm, the power source must be inspected and repaired

- Main focus of test: Transformer

2nd test: Primary circuit / earth

- Place a test-prod against one of the contacts of the mains plug (Fig.24)
- Place the second test-prod against the protective contact of the mains plug (Fig.24)
- Carry out the measurement
  - Insulation resistance must be > 2.5 MOhm

If the insulation resistance is less than 2.5 MOhm, the power source must be inspected and repaired

- Main focus of test: Transformer, transistor module on LCA15 board

Insulation test
(continued)

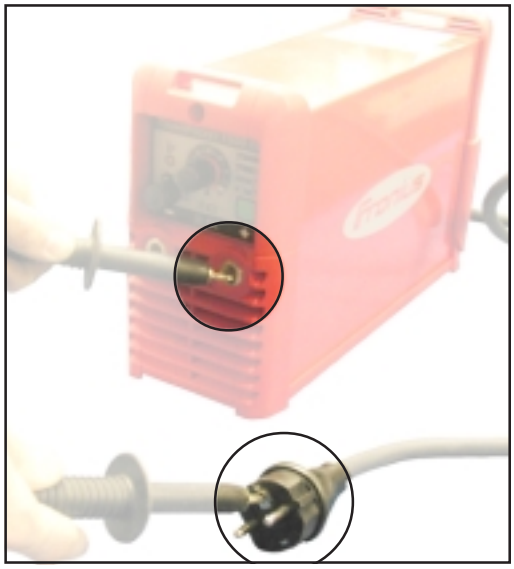


Fig.25 Insulation test - Secondary circuit / earth

3rd test: Secondary circuit / earth

- Place a test-prod against one of the welding sockets (e.g. ⊕ socket) (Fig.25)
- Place the second test-prod against the protective contact of the mains plug (Fig.25)
- Carry out the measurement
  - Insulation resistance must be > 2.5 MOhm

If the insulation resistance is less than 2.5 MOhm, the power source must be inspected and repaired

- Main focus of test: Transformer, secondary diode

GB

Maintenance and repair work

Installation instructions

On the following pages, you will find installation instructions for the most important assemblies in the TP 1500 power source.

The following list comprises all the installation instructions. For each set of installation instructions, the item numbers of the assemblies covered in this particular set of instructions are also given.

- Installation instructions “LCG15 board and secondary diode“
  Assembly: (3), (4)

- Installation instructions “LCA15 board“
  Assembly: (1)

- Installation instructions “FPA 15 board“
  Assembly: (5)

- Installation instructions “Varistor“
  Assembly: (2)

- Installation instructions “Transformer“
  Assembly: (8)

- Installation instructions “Temperature sensor“
  Assembly: (9)

- Installation instructions “Fan“
  Assembly: (10)

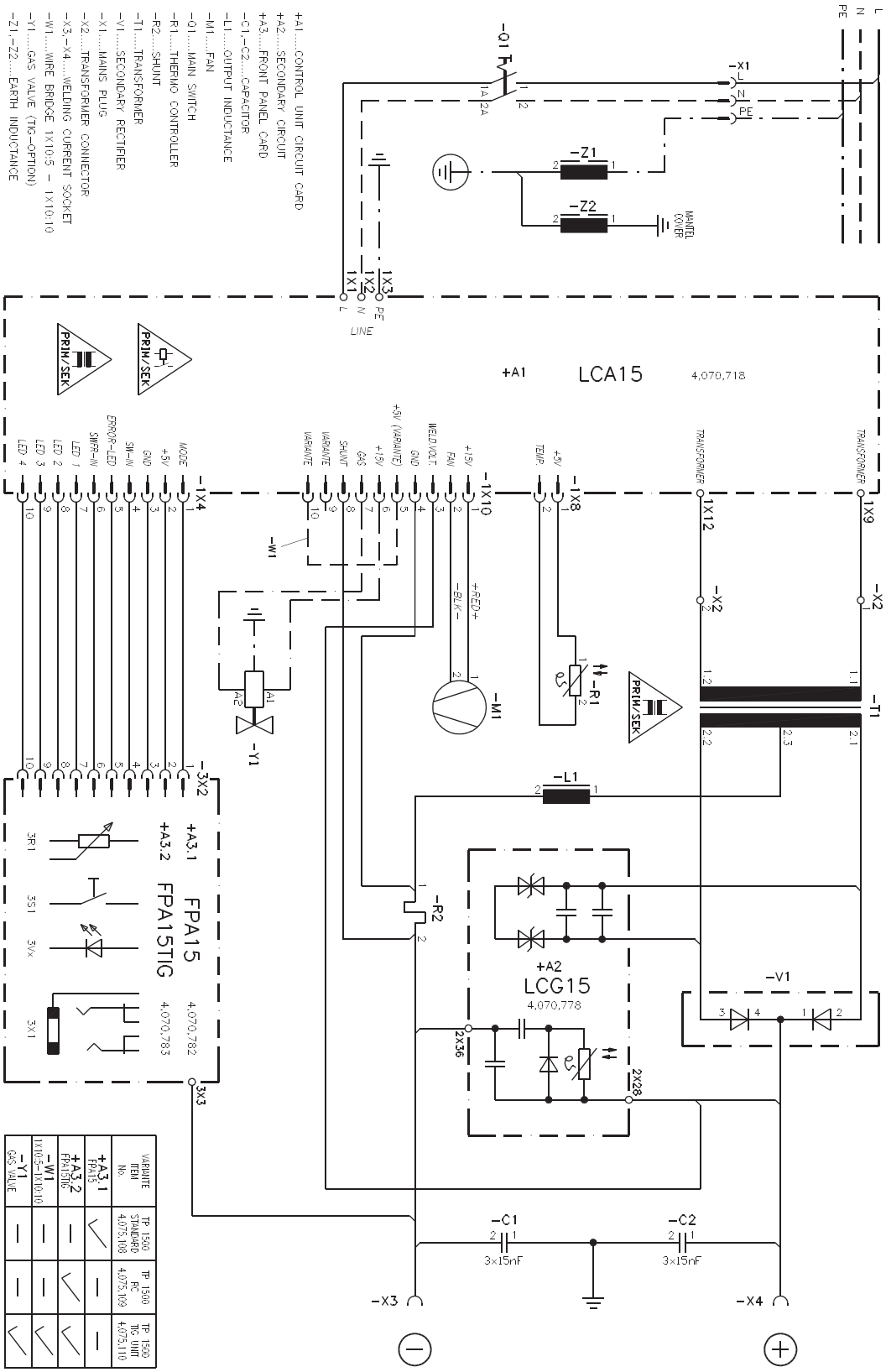
- Installation instructions “Mains switch and mains cable“
  Assembly: (11), (12)

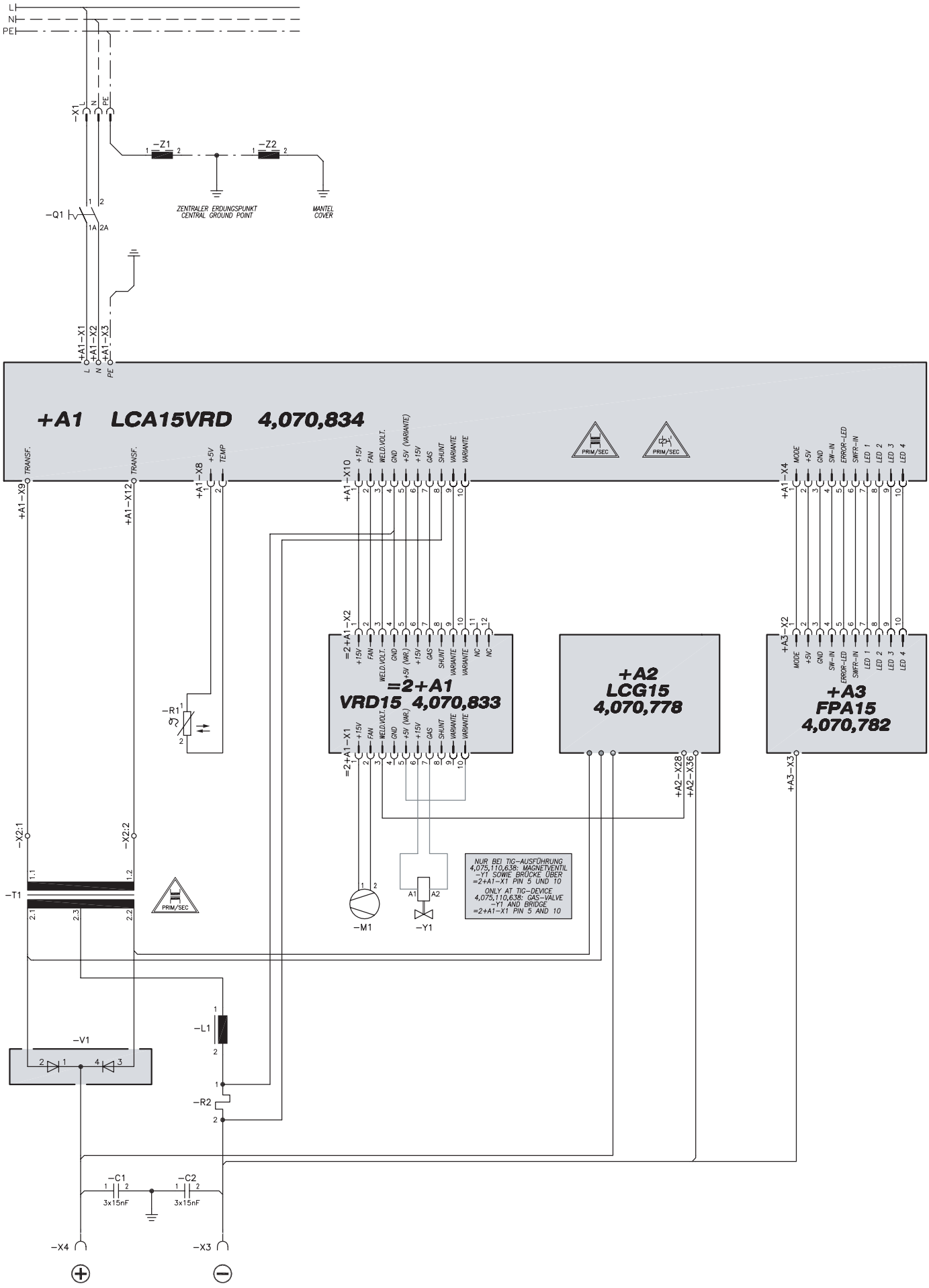
- Installation instructions “Gas solenoid valve“
  Assembly: (16)

- Installation instructions: Potentiometer, connection socket + seal for remote control unit
  Assembly: (7), (29), (30)

- Installation instructions: Front of housing, with adhesive label and welding sockets
  Assembly: (13), (14), (23), (26), (27), (28)

Overall circuit diagram




L
N
PE
-X1
-Z1
-Z2
ZENTRALER ERDUNGSPUNKT
CENTRAL GROUND POINT
MANTEL
COVER
-Q1
+A1-X1
+A1-X2
+A1-X3
+A1 LCA15VRD 4,070,834
PRIM/SEC
+A1-X9
+A1-X12
+A1-X8
+A1-X10
+A1-X4
=2+A1-X2
=2+A1
VRD15 4,070,833
=2+A1-X1
+A2
LCG15
4,070,778
+A3
FPA15
4,070,782
+A3-X2
+A3-X3
+A2-X28
+A2-X36
-X2:1
-X2:2
-T1
-R1
-M1
-Y1
-L1
-R2
-V1
-C1
-C2
3x15nF
-X4
-X3
NUR BEI TIG-AUSFÜHRUNG
4,075,110,638: MAGNETVENTIL
-Y1 SOWIE BRÜCKE ÜBER
=2+A1-X1 PIN 5 UND 10
ONLY AT TIG-DEVICE
4,075,110,638: GAS-VALVE
-Y1 AND BRIDGE
=2+A1-X1 PIN 5 AND 10

Installation instructions: LCG15 board and secondary diode

Safety

Warning! Work performed incorrectly can cause serious injury and damage. This modification may only be performed by suitably trained and skilled electricians! Before opening up the machine, shift the mains switch to the "0" position and unplug the machine from the mains!

Note! Follow the safety rules given in the Operating Instructions, especially the section headed "Safety inspection".

Scope of supply

The assembly “LCG 15 board” (4,070,778,Z) comprises the following component:

Item	Designation	N° of items
(3)	LCG15 board	1

The assembly “Secondary diode” (4,100,319) comprises the following components:

Item	Designation	N° of items
(4)	Secondary diode	1
(31)	Screws M4x14-TX20	2
(50)	Diode holder	1
(51)	Spacers	4
(52)	Screws M4x20-TX20	4
(53)	Cup springs	2

Tools needed

Designation

- Manual torque screwdriver (1 to 6 Nm, 42,0411,0013)
- Bit insert TX 20, for torque screwdriver
- Bit insert hexagon-socket, width-across 3, for torque screwdriver
- Molex extractor tool (42,0410,0290)
- Grinding paper (grain P 500 or finer)
- Contact spray

Opening the housing

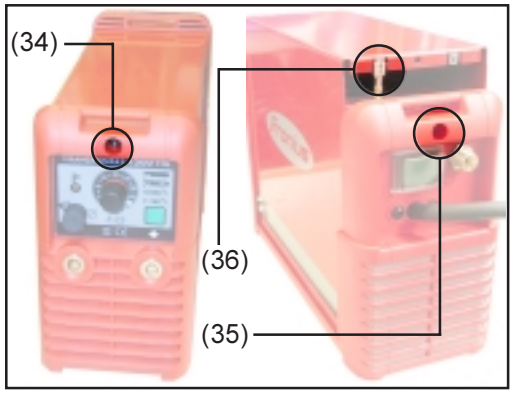


Fig.1

- Take off the carrying strap
- Undo the 5x25-TX20 screw (34) on the front of the housing
- Undo the 5x25-TX20 screw (35) on the rear of the housing
- Carefully lift the housing box and disconnect the “housing earth conductor” (36)

Opening the housing
(continued)

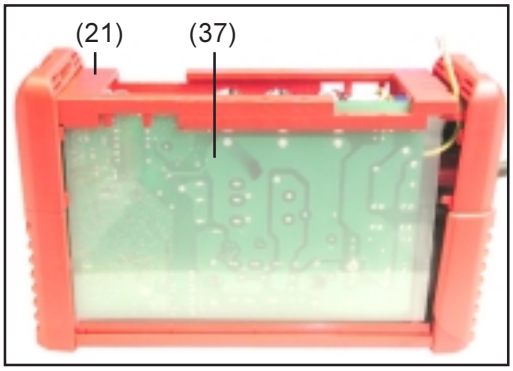


Fig.2

- Remove the housing stiffening element (21)
- Remove the board insulator (37)

Removing the LCG15 board

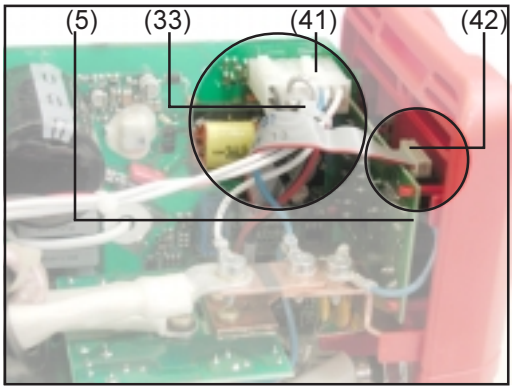


Fig.3

- Disconnect the ribbon cable (42) from the FPA15 board (5)
- Cut through the cable binder (33)
- Disconnect the 10-pole Molex plug (41) from the LCA15 board

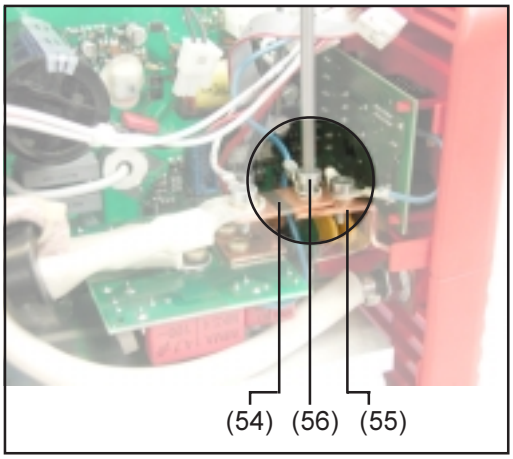


Fig.4

- Interrupt the connection between the shunt (54) and the copper bracket (55), by undoing the M5x12-TX20 screw (56)

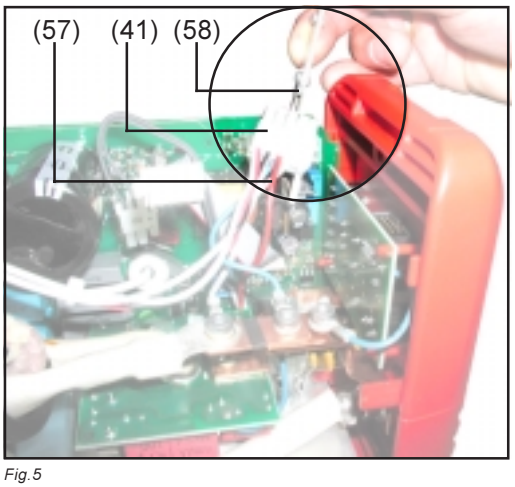


Fig.5

- Detach the welding-voltage measuring lead (red) (57) from the 10-pole Molex plug (41), 1X10/Pin3
  - preferably using the Molex extractor tool (58) (art. n° 42,0410,0290)

Removing the LCG15 board
(continued)

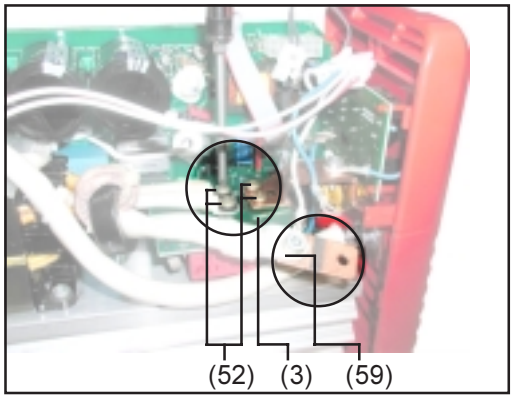


Fig.6

- Carefully bend the “centre-tap transformer lead“ (59) to one side
- Unscrew the 4 M4x20-TX20 screws (52) from the LCG 15 board (3)

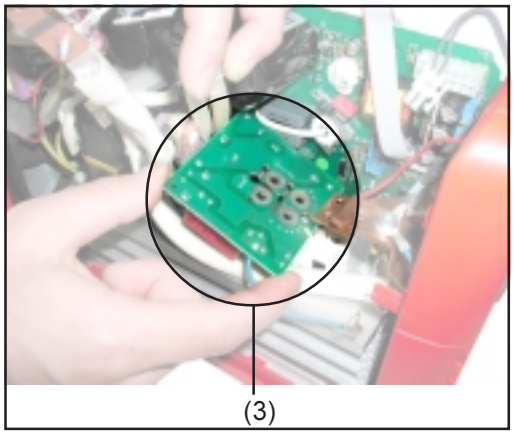


Fig.7

- Carefully detach the LCG15 board (3)

Removing the secondary diode

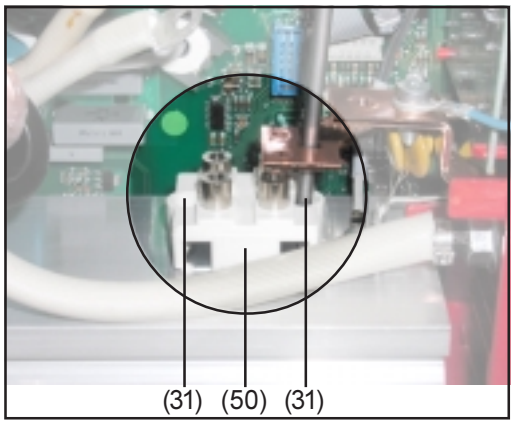


Fig.8

- Undo the 2 M4x14-TX20 screws (31) on the diode holder (50)
- Detach the secondary diode, together with the diode holder (50)

Fitting the secondary diode

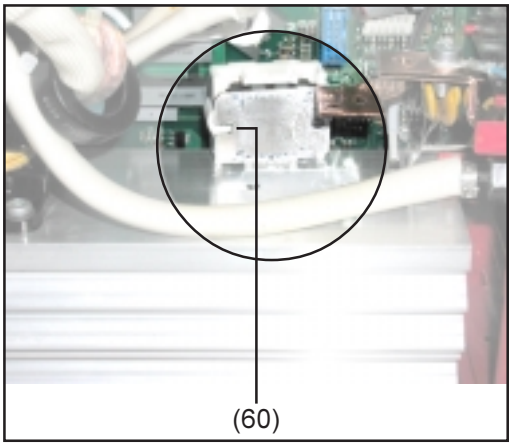


Fig.9

- Pre-clean the heat sink with contact spray and a non-linting cloth
- Remove any contamination or unevenness from the heat sink with fine abrasive paper (grain P 500 or finer)
- Clean the heat sink with contact spray and a non-linting cloth

Note! There already is a heat-transfer film affixed to the secondary diode.

- Do not apply any heat-transfer compound in addition to this film
- Do NOT peel off the heat-transfer film from the underside of the secondary diode

Note! When mounting the secondary diode, make sure that the U-shaped recess (60) is pointing towards the transformer.

All parts must be kept clean! Any contamination between the secondary diode and the heat sink will impair the heat-transfer.

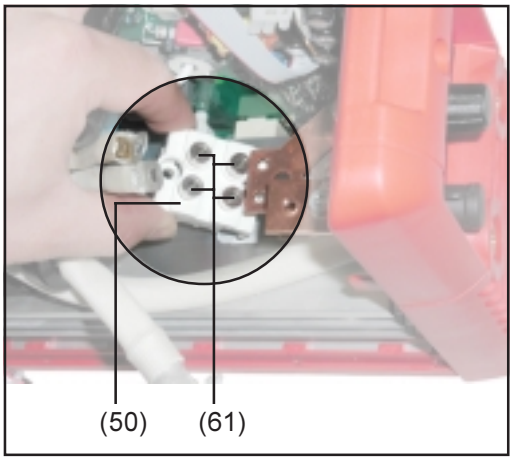


Fig.10

- Put the diode holder (50) over the secondary diode
- Insert 4 spacers (61) into the diode holder
- Place the secondary diode, complete with the diode holder and the inserted spacers (61), onto the heat sink

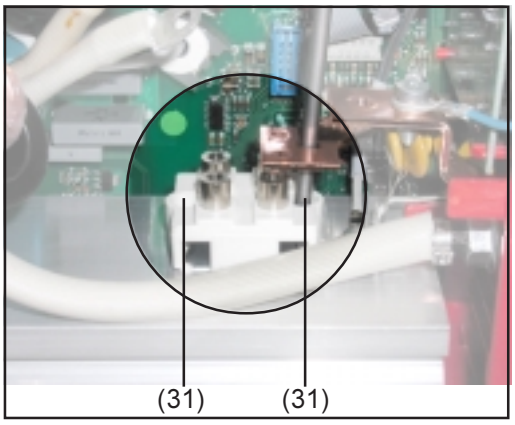


Fig.11

- Slightly tighten the M4x14-TX20 screws (31)

Note! Before you tighten the M4x14-TX20 screws (31), the secondary diode must be lying completely flat on the heat sink, without any gaps.

- Tighten the M4x14-TX20 screws (31) with a torque of 2,1 Nm

Fitting the LCG15 board - secondary diode with two cup springs

If the secondary diode is equipped with two cup springs, please proceed according to the following procedure:

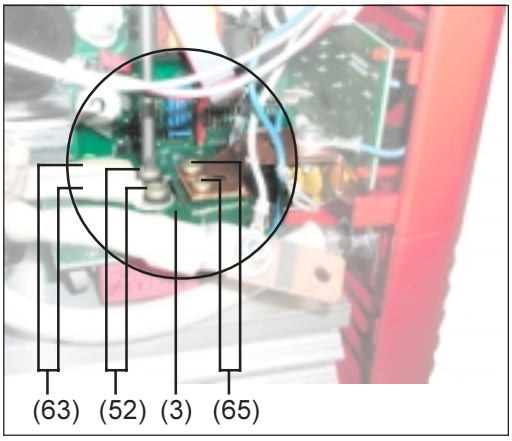


Fig.12

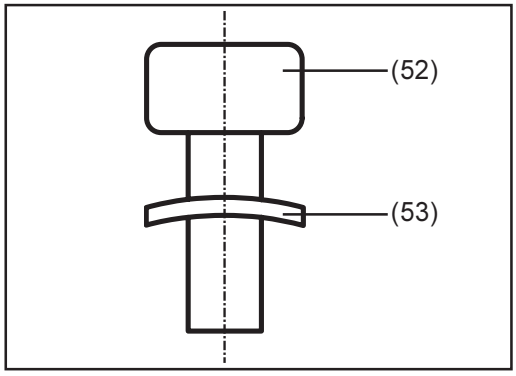


Fig.13

- Place the LCG15 board (3) onto the spacers on the diode holder, in the correct position
- Slightly tighten the two M4x20-TX20 screws (65), (without cup springs)

Note! Before inserting the two M4x20-TX20 screws (52) into their holes, push the cup springs (53) - Fig.13 - onto the M4x20-TX20 screws (52).

Make sure that the “Secondary diode transformer leads“ (63) between the cable lugs are as far as possible apart.

Note! When tightening the M4x20-TX20 screws (52) and (65), do not exceed a torque of 1.5 Nm. If you turn the screws any tighter than this, you risk destroying the secondary diode.

- Tighten M4x20-TX20 screws (52) and (65) with a torque of 1.5 Nm

Fitting the LCG15 board - secondary diode with four cup springs

If the secondary diode is equipped with four cup springs, please proceed according to the following procedure:

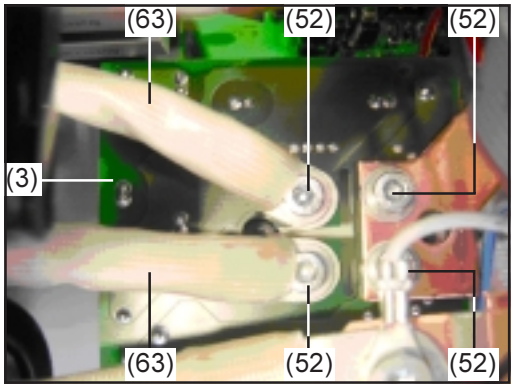


Fig.14

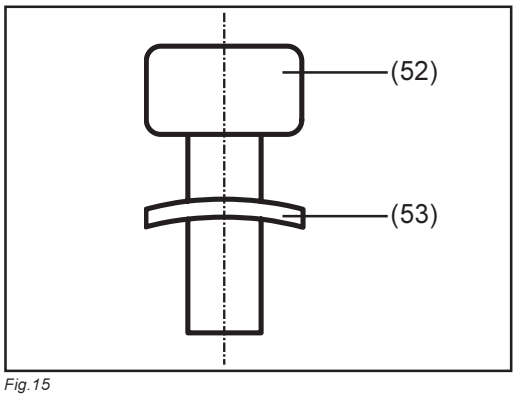


Fig.15

1. Place the LCG15 board (3) onto the spacers on the diode holder, in the correct position

N.B.! Before inserting the 4 hexagon-socket screws M4x22 - width-across 3 - (52) into their holes, push the cup springs (53) - Fig.13 - onto the screws (52).

Make sure that the “Secondary diode transformer leads“ (63) between the cable lugs are as far as possible apart.

N.B.! When tightening the screws (52), do not exceed a torque of 1.5 Nm. If you turn the screws any tighter than this, you risk destroying the secondary diode.

2. Tighten the hexagon-socket screws M4x22 - width-across 3 - (52) with a torque of 1.5 Nm

Mounting the shunt and connecting the leads

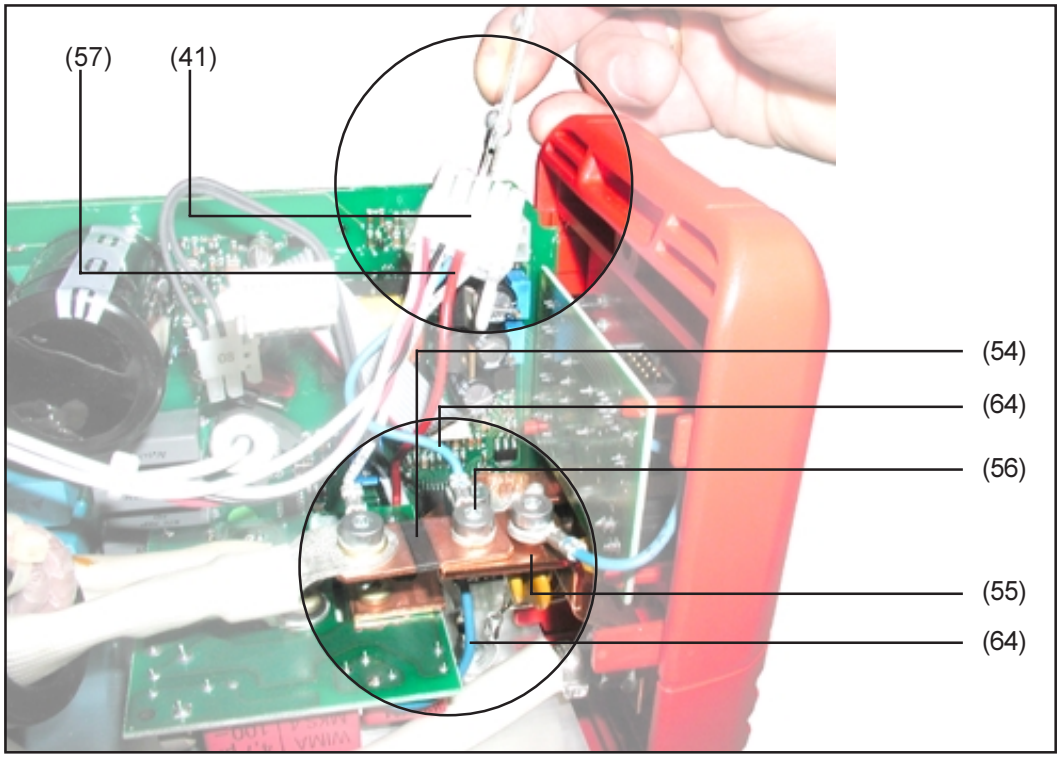


Fig.16

- Fasten the shunt (54) and the two leads “Socket X3” (blue) (64) to the copper bracket (55)
  - tighten the M5x12-TX20 screw (56) with a torque of 2 Nm
- Insert the welding-voltage measuring lead (red) (57) into the 10-pole Molex plug (41) 1X10/Pin3

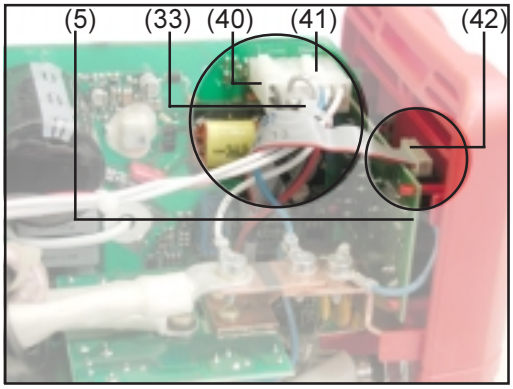


Fig.17

- Plug the 10-pole Molex plug (41) onto board LCA15/1X10
- Fix the cable harness for Molex plugs (40) and (41), using a cable binder (33)

Note! Before plugging in the ribbon cable (42), pass it across the cable harness for Molex plugs (40) and (41).

- Arrange the ribbon cable (42) above the cable harness, as shown in Fig.15
- Plug the ribbon cable (42) to board FPA15 (5)

Closing the housing

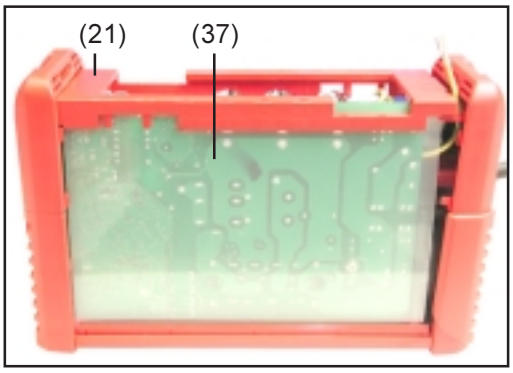


Fig.18

- Insert the board insulator (37)
- Insert the housing stiffening element (21)

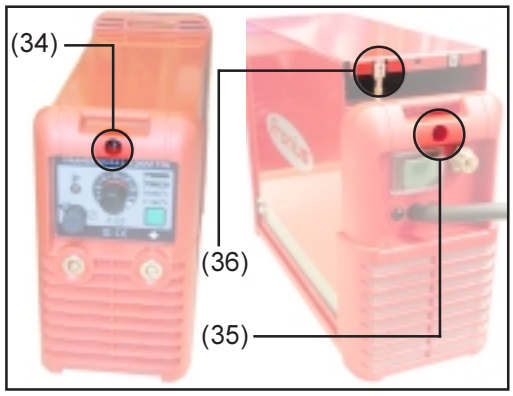


Fig.19

- Plug the “housing earth conductor” (36) onto the housing box, in the correct position
- Replace the housing box
- Screw the 5x25-TX20 screw (35) back onto the rear of the housing
- Screw the 5x25-TX20 screw (34) back onto the front of the housing
- Fit the carrying strap back on again

Installation instructions: LCA15 board

Safety

Warning! Work performed incorrectly can cause serious injury and damage. This modification may only be performed by suitably trained and skilled electricians! Before opening up the machine, shift the mains switch to the "0" position and unplug the machine from the mains!

Note! Follow the safety rules given in the Operating Instructions, especially the section headed "Safety inspection".

Scope of supply

The assembly “LCA 15 board“ (4,070,718,Z) comprises the following components:

Item	Designation	N° of items
(1)	LCA15 board	1
(31)	M4x14 screws (TX20)	2
(32)	Cup springs	2
(33)	Cable binders	2

Tools needed

Designation

- Manual torque screwdriver (1 to 6 Nm, 42,0411,0013)
- Bit insert TX 20, for torque screwdriver
- Grinding paper (grain P 500 or finer)
- Contact spray

Additional tools needed

- Socket spanner holder with 1/4” external hexagonal-socket drive and 1/4’’ external square-socket drive, to fit torque screwdriver
- Socket-spanner insert - width-across 7- with 1/4’’ internal square-socket drive

Opening the housing

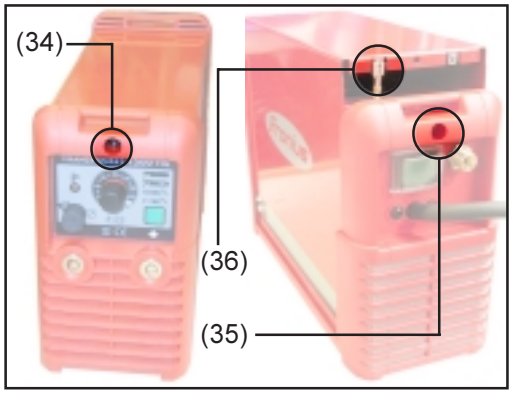


Fig.1

- Take off the carrying strap
- Undo the 5x25-TX20 screw (34) on the front of the housing
- Undo the 5x25-TX20 screw (35) on the rear of the housing
- Carefully lift the housing box and disconnect the “housing earth conductor” (36)

Opening the housing
(continued)

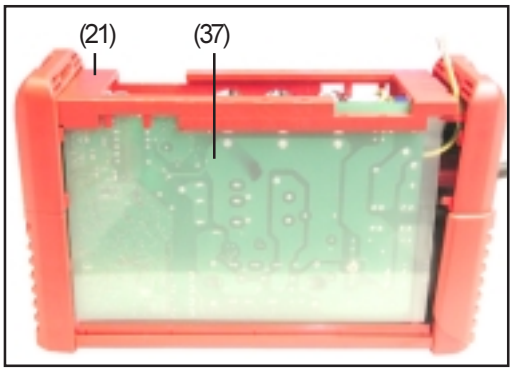


Fig.2

- Remove the housing stiffening element (21)
- Remove the board insulator (37)

Removing the LCA15 board

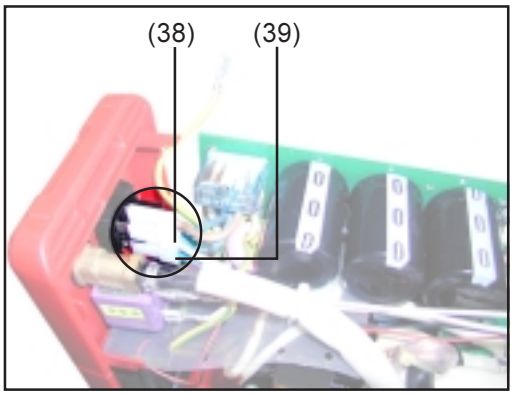


Fig.3

- Unplug the mains leads for the LCA15 board from the mains switch
  - L (white) from 1A (38)
  - N (blue) from 2A (39)

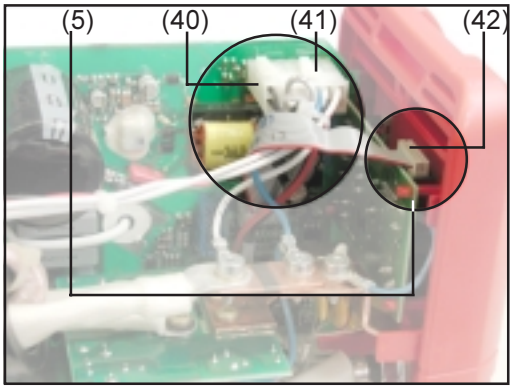


Fig.4

- Disconnect the ribbon cable (42) from the FPA15 board (5)
- Unplug the 2-pole Molex plug (40) from the LCA15 board
- Disconnect the 10-pole Molex plug (41) from the LCA15 board

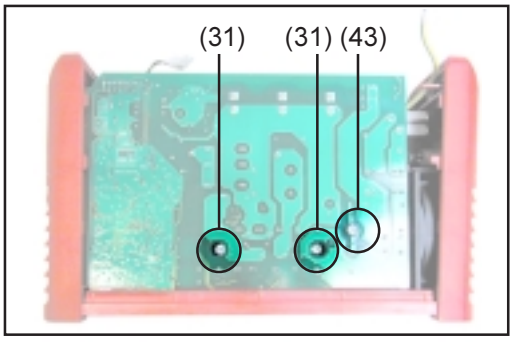


Fig.5

Note! Undo the two M4x14 screws (31) first, and only then undo the M4 screw (43)

- Undo the two M4x14-TX20 screws (31) (with cup springs) on the LCA15 board
- Undo the M4 screw (43) on the LCA15 board

Removing the LCA15 board
(continued)

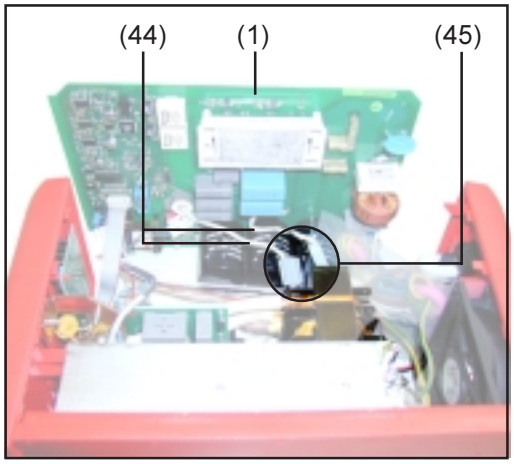


Fig.6

Note! When detaching the LCA15 board (1), make sure that you do not kink or pinch any cables, or subject them to tensile strain.

- Carefully detach the LCA15 board (1) from the heat sink

Note! When disconnecting the transformer leads (44) for the LCA15 board, squeeze the WAGO connectors (45) completely together.

- Disconnect the “LCA15 board transformer leads” (44)

Fitting the LCA15 board


Fig.7

- Pre-clean the heat sink with contact spray and a non-linting cloth
- Remove any contamination or unevenness from the heat sink with fine abrasive paper (grain P 500 or finer)
- Clean the heat sink with contact spray and a non-linting cloth

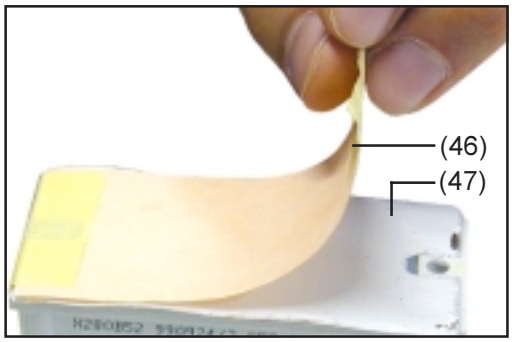


Fig.8

- Peel off the protective film (46) from the transistor module (47)

Fig.9

Note! Before mounting the LCA15 board, check that the M4x17 earthing stud (48) - width-across 7 - is mounted firmly. If necessary, tighten it with a torque of 2 Nm.

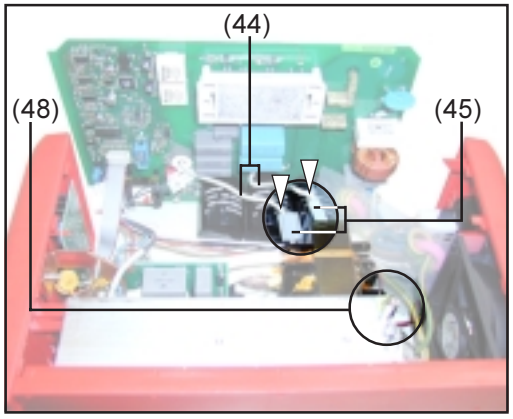


Fig.10

Note! When connecting the transformer leads (44) for the LCA15 board, squeeze the WAGO connectors (45) completely together. There is no need to worry about correct polarity here.

- Insert the “LCA15 board transformer leads” into the WAGO connectors (45) (see arrows) as far as they will go, and check that they are firmly fixed.

Fitting the LCA15 board
(continued)

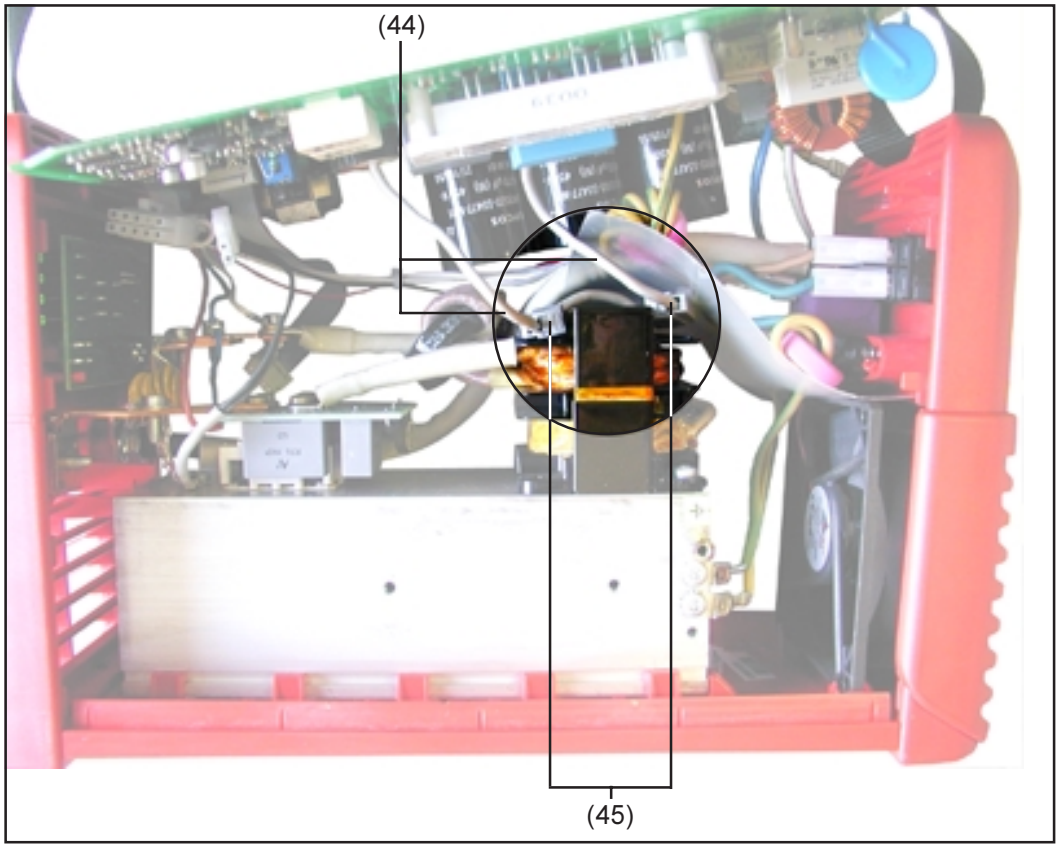


Fig.11

- Arrange the “LCA15 board transformer leads” (44) in such a way that the WAGO connectors (45) are resting on the transformer coil body, as shown in Fig.11

Note! When fitting the LCA15 board in place, make sure that the “LCA15 board transformer leads” (44) are not trapped between the transistor module and the heat sink.

All parts must be kept clean! Any contamination between the transistor module and the heat sink will impair the heat-transfer.

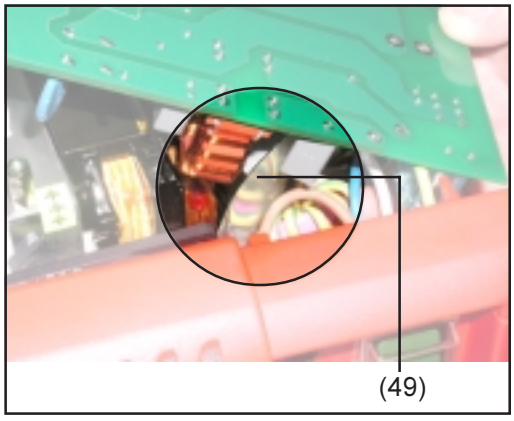


Fig.12

Note! When fitting the LCA15 board in place, make sure that the air-guide film (49) is arranged as shown in Fig. 12.

Fitting the LCA15 board
(continued)

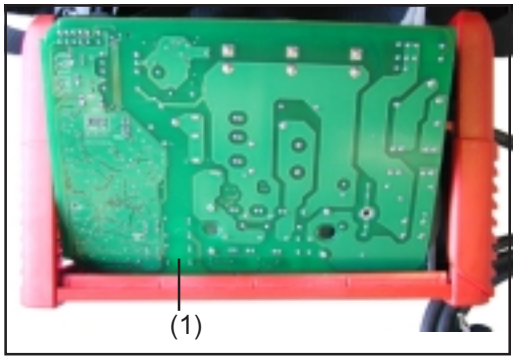


Fig.13

- Carefully place the LCA15 board (1), underside first, onto the heat sink

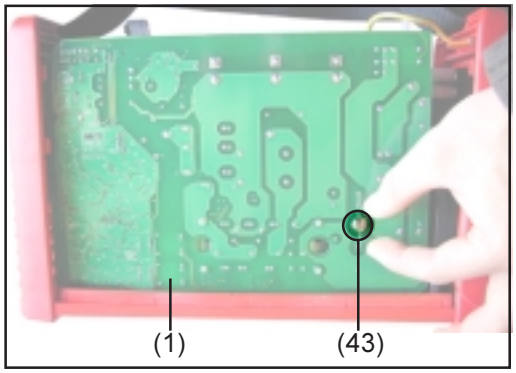


Fig.14

- To position the LCA15 board (1), gently screw the M4 screw (43) into the M4x17 earthing stud (48) - see Fig.10 - by hand.

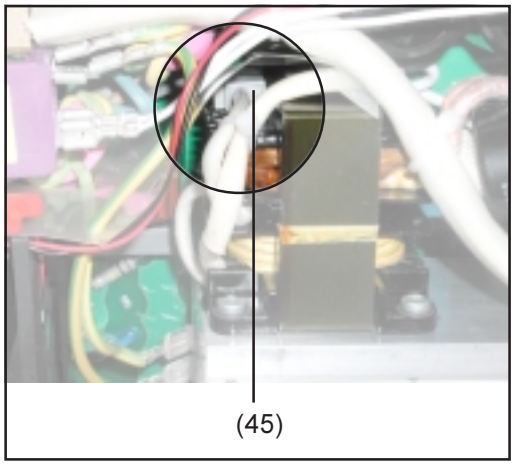


Fig.15a

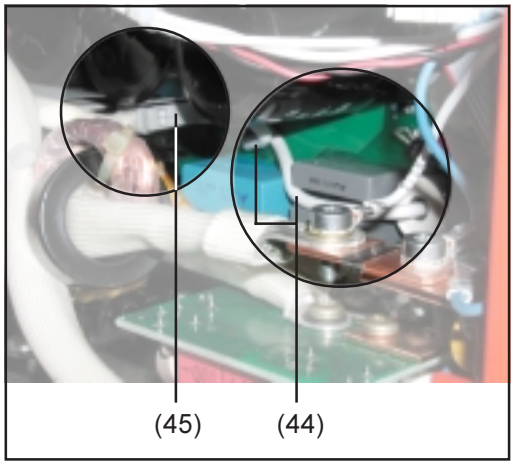


Fig.15b

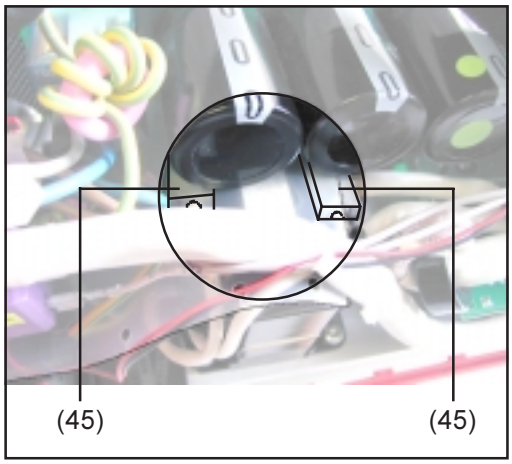


Fig.15c

- Arrange the transformer leads (44) for the LCA 15 board as shown in Fig.15, and stow away the WAGO connectors (45)

Fitting the LCA15 board
(continued)

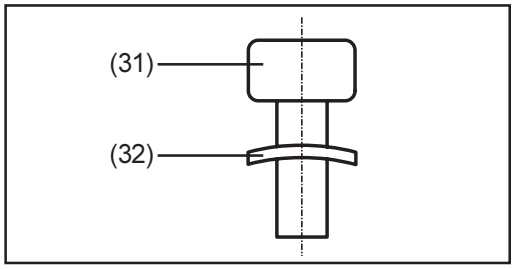


Fig.16

Note! Before inserting the M4x14-TX20 screws (31) into their holes, push the cup springs (32) onto the M4x14-TX20 screws (31), as shown in Fig.16.

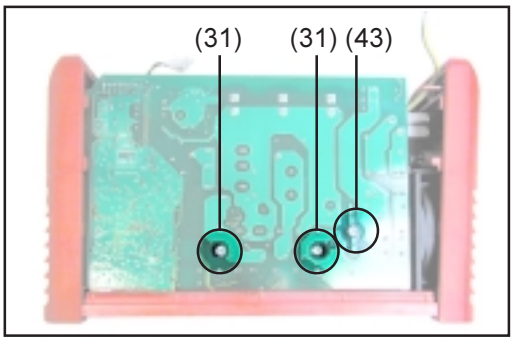


Fig.17

- Carefully turn the M4x14-TX20screws (31), alternately, until you start to feel gentle resistance

Note! Before you tighten the M4x14-TX20 screws (31), the transistor module must be lying completely flat on the heat sink, without any gaps.

- Pre-mount the M4x14-TX20 screws (31) with a torque of 0.6 Nm
- Tighten the M4x14-TX20 screws (31) with a torque of 2 Nm
- Tighten the M4 screw (43) with a torque of 1.5 Nm

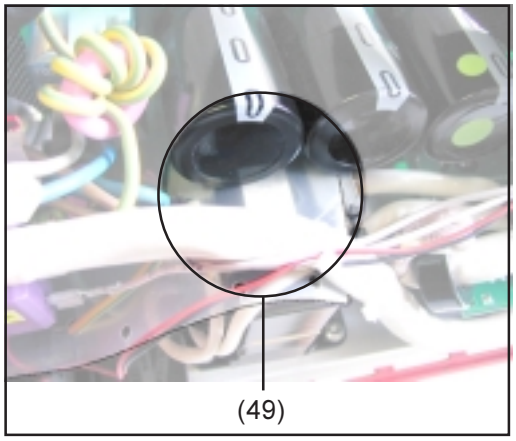


Fig.18

Note! Make sure that the air-guide film (49) is in the correct position.

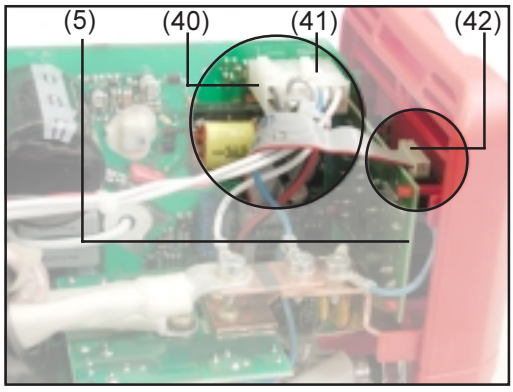


Fig.19

- Plug the 10-pole Molex plug (41) onto board LCA15
- Plug the 2-pole Molex plug (40) onto board LCA15

Note! Before plugging in the ribbon cable (42), pass it across the cable harness for Molex plugs (40) and (41), as shown in Fig. 19.

- Arrange the ribbon cable (42) above the cable harness, as shown in Fig.19
- Plug the ribbon cable (42) to board FPA15 (5)

Fitting the LCA15 board
(continued)

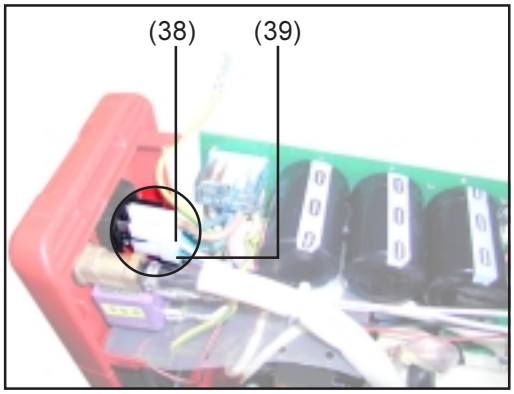


Fig.20

- Plug the mains leads for the LCA15 board back onto the mains switch
  - L (white) (38) to 1A
  - N (blue) (39) to 2A

Closing the housing

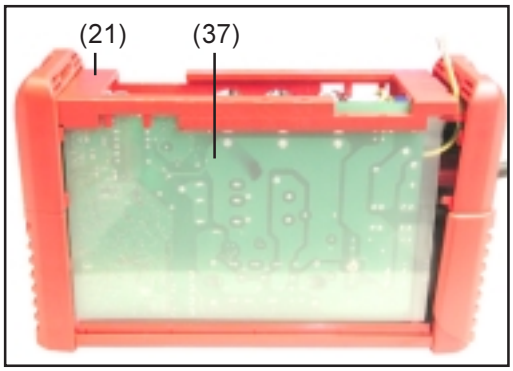


Fig.21

- Insert the board insulator (37)
- Insert the housing stiffening element (21)

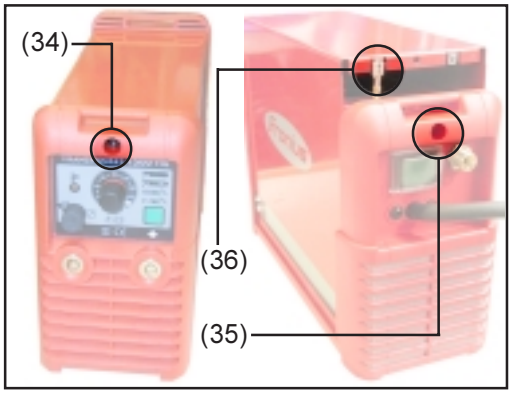


Fig.22

- Plug the “housing earth conductor” (36) onto the housing box, in the correct position
- Replace the housing box
- Screw the 5x25-TX20 screw (35) back onto the rear of the housing
- Screw the 5x25-TX20 screw (34) back onto the front of the housing
- Fit the carrying strap back on again

Installation instructions: FPA15 board

GB

Safety

Warning! Work performed incorrectly can cause serious injury and damage. This modification may only be performed by suitably trained and skilled electricians! Before opening up the machine, shift the mains switch to the "0" position and unplug the machine from the mains!

Note! Follow the safety rules given in the Operating Instructions, especially the section headed "Safety inspection".

Scope of supply

The assembly “FPA 15 board” comprises the following component:

Item	Designation	N° of items
(5)	FPA15 board (TP 1500 RC / 1500 TIG: 4,070,783,Z)	1
	FPA15 board (TP 1500: 4,070,782,Z)	1

Tools needed

Designation
- Manual torque screwdriver (1 to 6 Nm, 42,0411,0013)
- Bit insert TX 20, for torque screwdriver

Additional tools needed

- Socket spanner holder with 1/4’’ external hexagonal-socket drive and 1/4’’ external square-socket drive, to fit torque screwdriver
- Socket-spanner insert - width-across 7- with 1/4’’ internal square-socket drive

Opening the housing

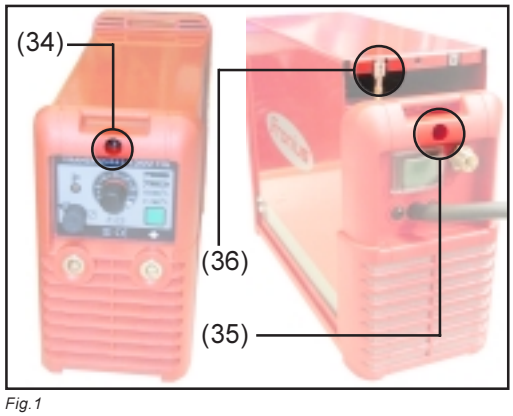


Fig.1

- Take off the carrying strap
- Undo the 5x25-TX20 screw (34) on the front of the housing
- Undo the 5x25-TX20 screw (35) on the rear of the housing
- Carefully lift the housing box and disconnect the “housing earth conductor” (36)

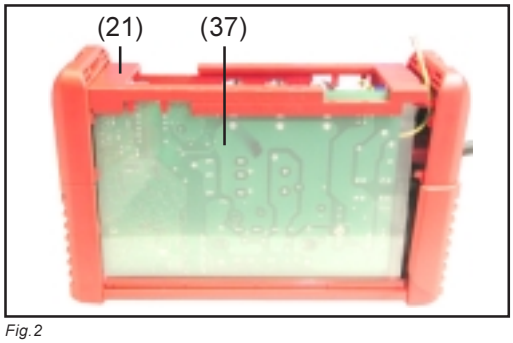


Fig.2

- Remove the housing stiffening element (21)
- Remove the board insulator (37)

Removing the FPA15 board

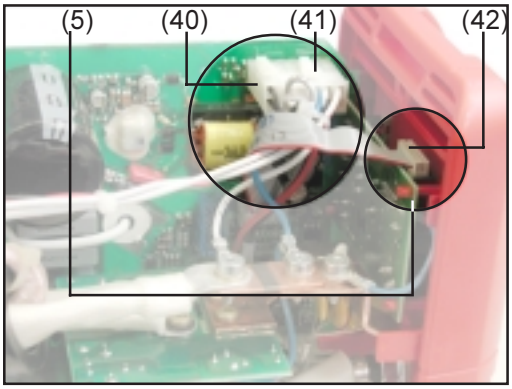


Fig.3

- Disconnect the ribbon cable (42) from the FPA15 board (5)
- Unplug the 2-pole Molex plug (40) from the LCA15 board
- Disconnect the 10-pole Molex plug (41) from the LCA15 board

Fig.4

- Take off the cap from the “Welding-amperage setting dial“ (6)

Note! When undoing the fixing nut for the “Welding-amperage setting dial“, hold the dial (6) firmly

- Undo the fixing nut of the setting dial (6) with the socket spanner (width-across 7)
- Detach the setting dial (6)

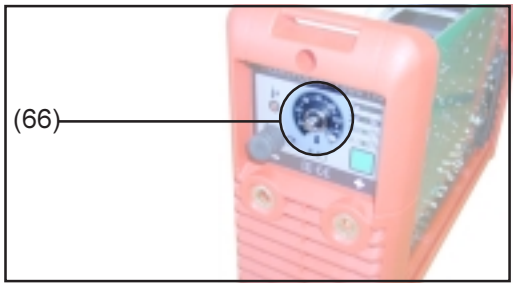


Fig.5

- Undo and remove the round nut (66)

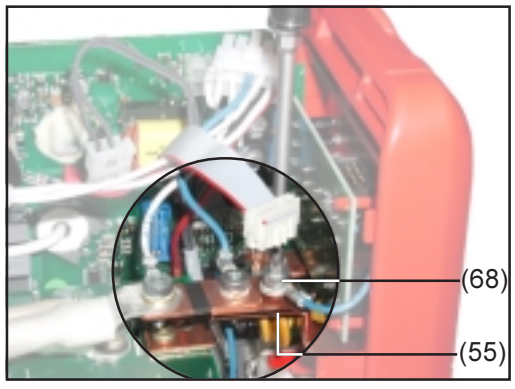


Fig.6

- Undo the M5x12 - TX20 screw (68) on the copper bracket (55)

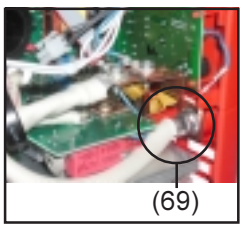


Fig.7

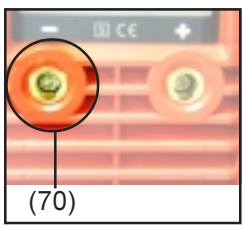


Fig.8

- **TP 1500 TIG:** Loosen the hexagon nut (69) (width-across=13) for the screw-fixing of the ⊖ socket
- **TP 1500 / 1500 RC:** In the ⊖ socket, loosen the M5x12 (TX20) screw (70)

Removing the FPA15 board
(continued)

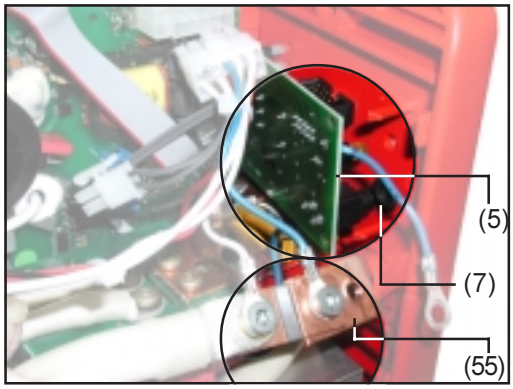


Fig.9

- Swing the copper bracket (55) to one side

Note! First carefully detach the FPA15 board (5) from the front alignment pins.

- Carefully lift the FPA15 board (5) and remove it

Fitting the FPA15 board

Note! Before fixing the FPA15 board (5) on the alignment pins, do the following:

- TP 1500 RC / 1500 TIG: Apply a thin layer of lubricant to the seal of the remote-control socket (7) (Fig.10)
- TP 1500 RC / 1500 TIG: Apply gentle pressure to the seal of the remote-control socket (7), to prevent it being forced out when you press on the FPA15 board
- Snap the FPA15 board (5) onto the rear alignment pin first

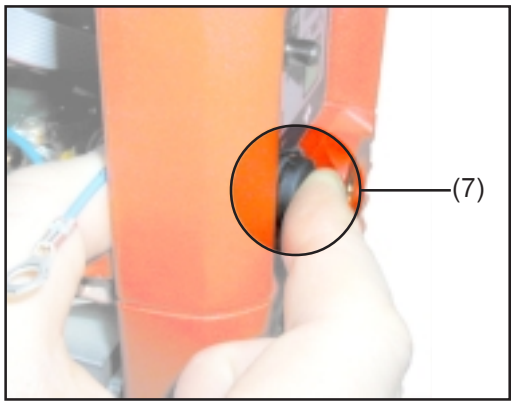


Fig.10

- Carefully press the FPA15 board until all the alignment pins have snapped into place

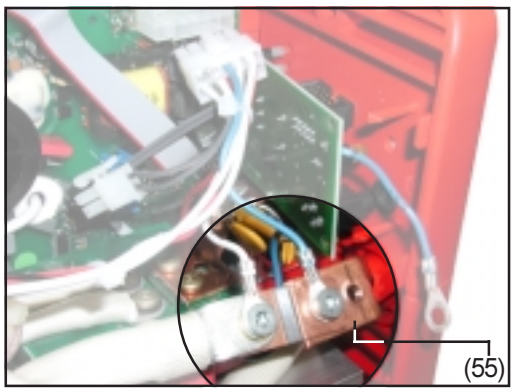


Fig.11

- Swing the copper bracket (55) back into its original position

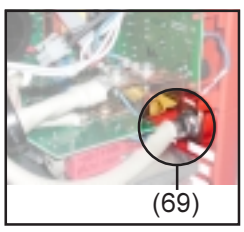


Fig.12

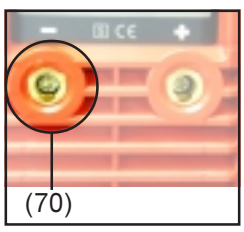


Fig.13

- **TP 1500 TIG:** Tighten the hexagon nut (69) (width-across=13) for the screw-fixing of the ⊖ socket
- **TP 1500 / 1500 RC:** In the ⊖ socket, tighten the M5x12 (TX20) screw (70)

Fitting the FPA15 board
(continued)

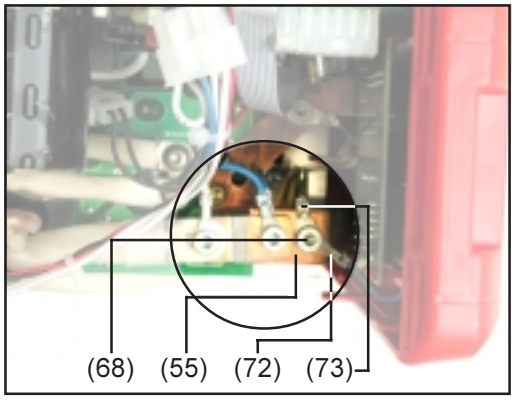


Fig.14

- Fasten the X3 cable (blue) (72) and the by-pass capacitors (73) onto the copper bracket (55), using the 5x12 - TX20 screw (68)
  - Tighten the 5x12 - TX20 screw (68) with a torque of 2 Nm

Fig.15

- Thigthen the round nut (66)

Fig.16

- Replace the setting dial (6)

Note! When thigthening the fixing nut for the “Welding-amperage setting dial“, hold the dial (6) firmly

- Thigthen the fixing nut of the setting dial (6) with the socket spanner (width-across 7)
- Replace the cap to the “Welding-amperage setting dial“ (6)

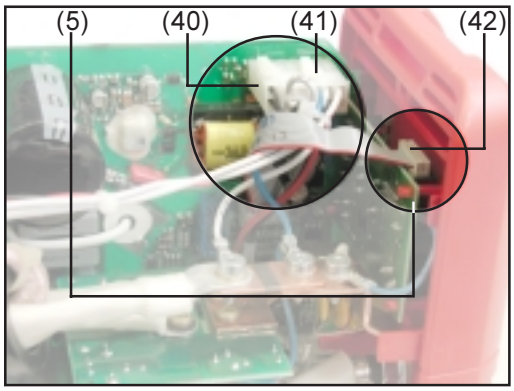


Fig.17

- Plug the 10-pole Molex plug (41) onto board LCA15
- Plug the 2-pole Molex plug (40) onto board LCA15
- Arrange the ribbon cable (42) above the cable harness, as shown in Fig.17
- Plug the ribbon cable (42) to board FPA15 (5)

Closing the housing

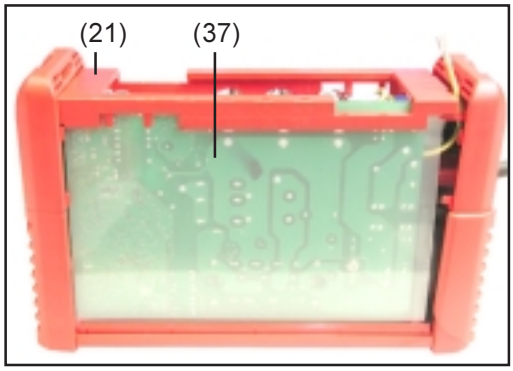


Fig.16

- Insert the board insulator (37)
- Insert the housing stiffening element (21)

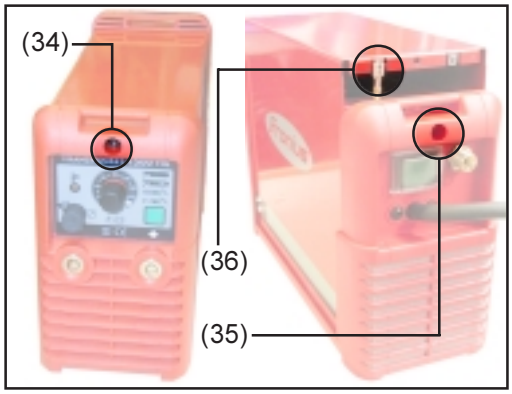


Fig.17

- Plug the “housing earth conductor” (36) onto the housing box, in the correct position
- Replace the housing box
- Screw the 5x25-TX20 screw (35) back onto the rear of the housing
- Screw the 5x25-TX20 screw (34) back onto the front of the housing
- Fit the carrying strap back on again

Installation instructions: Varistor

Safety

Warning! Work performed incorrectly can cause serious injury and damage. This modification may only be performed by suitably trained and skilled electricians! Before opening up the machine, shift the mains switch to the "0" position and unplug the machine from the mains!

Note! Follow the safety rules given in the Operating Instructions, especially the section headed "Safety inspection".

Scope of supply

The assembly “Varistor“ (41,0001,0627) comprises the following component:

Item	Designation	N° of items
(2)	Varistor	1

Tools needed

Designation

- Bit insert TX 20
- Soldering iron
- Soldering tin
- Solder absorption strand
- Suction pump (as an alternative to the solder absorption strand)

Opening the housing

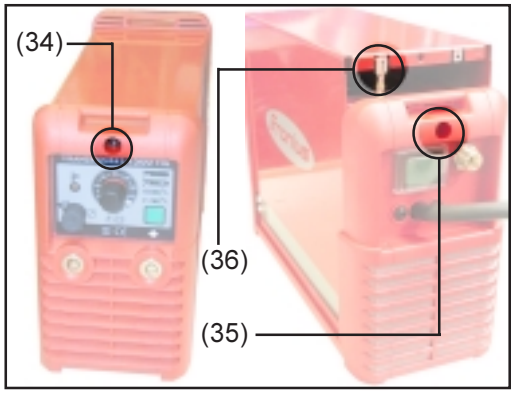


Fig.1

- Take off the carrying strap
- Undo the 5x25-TX20 screw (34) on the front of the housing
- Undo the 5x25-TX20 screw (35) on the rear of the housing
- Carefully lift the housing box and disconnect the “housing earth conductor” (36)

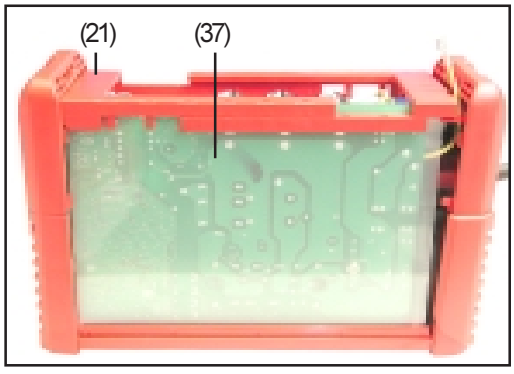


Fig.2

- Remove the housing stiffening element (21)
- Remove the board insulator (37)

Removing the varistor

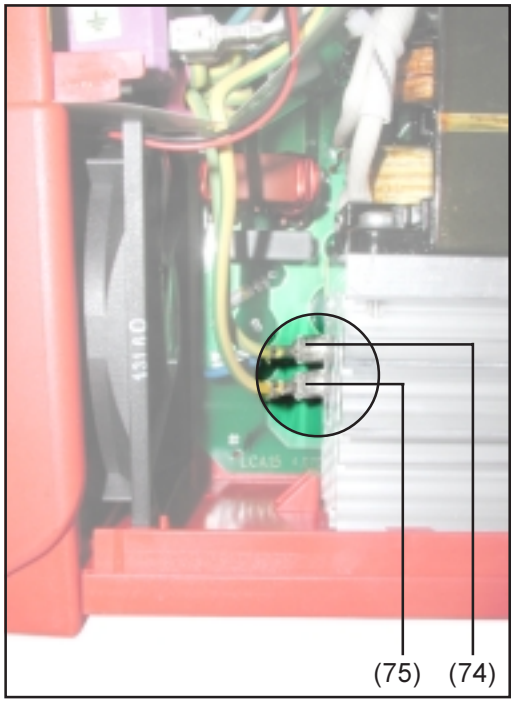


Fig.3

- Unplug the mains-cable earthing conductor (74)
- Unplug the heat-sink earthing conductor (75)

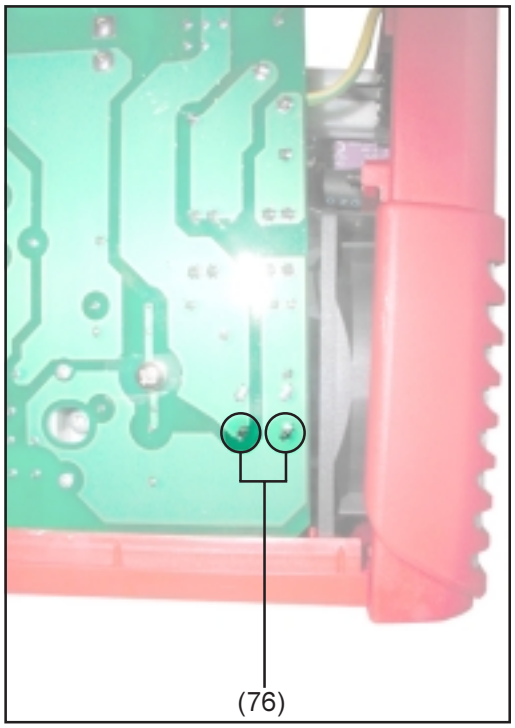


Fig.4

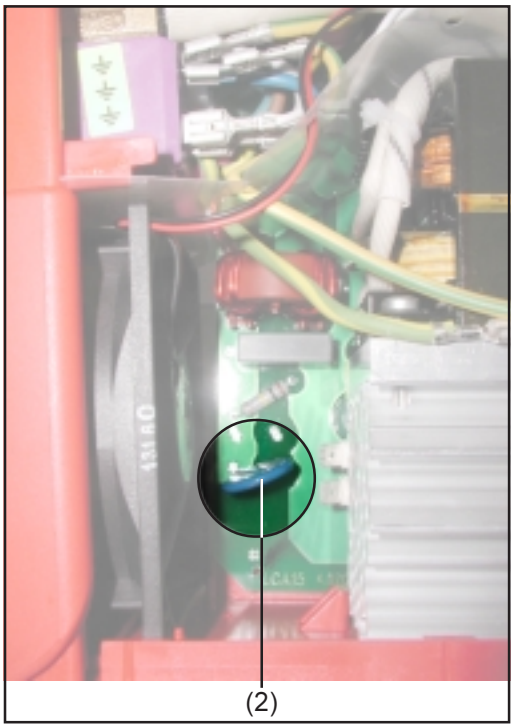


Fig.5

Note! Never use force to detach the varistor (2) from the LCA 15 board. Before any work involving the soldering iron, always clean the tip of the soldering iron.

- Completely remove the solder from the soldering points (76), using a solder absorption strand or suction pump
- Using a pair of pointed pliers, carefully detach the varistor (2) from the LCA 15 board

Fitting the varistor

Note! Before any work involving the soldering iron, always clean the tip of the soldering iron.

- Use the soldering iron to heat up the soldering points (76), and remove the liquid soldering tin as completely as possible with the aid of a suction pump or solder absorption strand.

Note! There is no need to ensure any particular polarity when mounting the varistor.

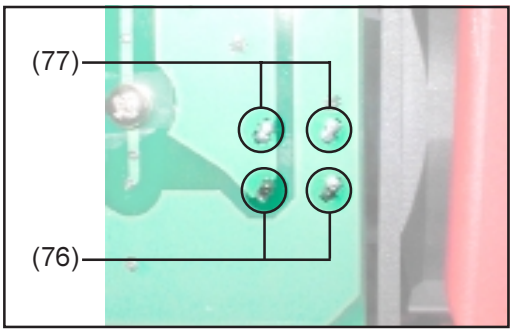


Fig.6

If the soldering points (76) are burned-out, it is also possible to insert the varistor into the repair soldering points (77).

- Carefully insert the varistor into the soldering points (76), and hold it in place

Note! Only use special electronics soldering tin for soldering on the varistor

- Solder the varistor to the soldering points (76) or (77)

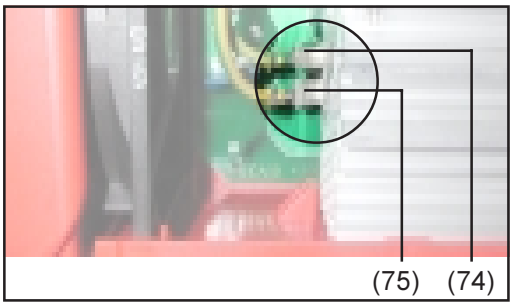


Fig.7

- Plug the mains-cable earthing conductor (74) back on
- Plug the heat-sink earthing conductor (75) back on

Closing the housing

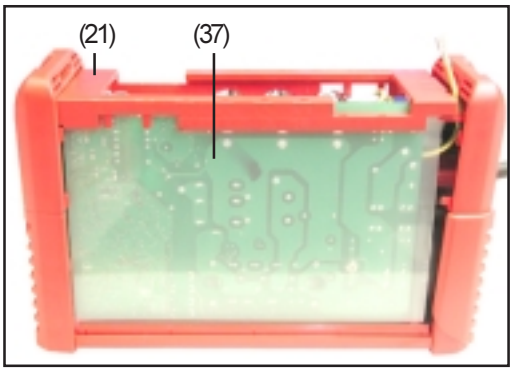


Fig.8

- Insert the board insulator (37)
- Insert the housing stiffening element (21)

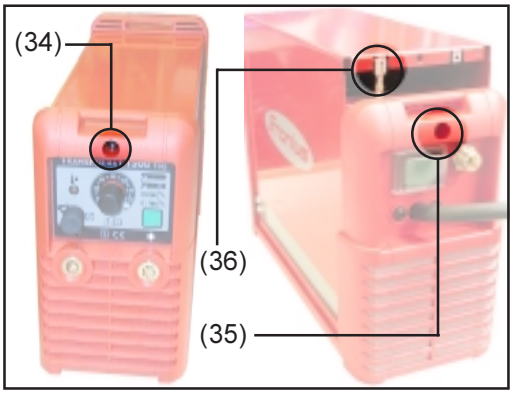


Fig.9

- Plug the “housing earth conductor” (36) onto the housing box, in the correct position
- Replace the housing box
- Screw the 5x25-TX20 screw (35) back onto the rear of the housing
- Screw the 5x25-TX20 screw (34) back onto the front of the housing
- Fit the carrying strap back on again

Installation instructions: Transformer

Safety

Warning! Work performed incorrectly can cause serious injury and damage. This modification may only be performed by suitably trained and skilled electricians! Before opening up the machine, shift the mains switch to the "0" position and unplug the machine from the mains!

Note! Follow the safety rules given in the Operating Instructions, especially the section headed "Safety inspection".

Scope of supply

The assembly “Transformer“ (33,0005,4123) comprises the following component:

Item	Designation	N° of items
(4)	Transformer	1

Tools needed

Designation

- Manual torque screwdriver (1 to 6 Nm, 42,0411,0013)
- Bit insert TX 20, for torque screwdriver
- Grinding paper (grain P 500 or finer)
- Contact spray

Additional tools needed

- Socket spanner holder with 1/4” external hexagonal-socket drive and 1/4’’ external square-socket drive, to fit torque screwdriver
- Socket spanner insert - width-across 7 - with 1/4’’ internal square-socket drive
- Heat-transfer compound
- Foamed plastic roller
- Smooth, clean surface (e.g. coated wooden board)

Opening the housing

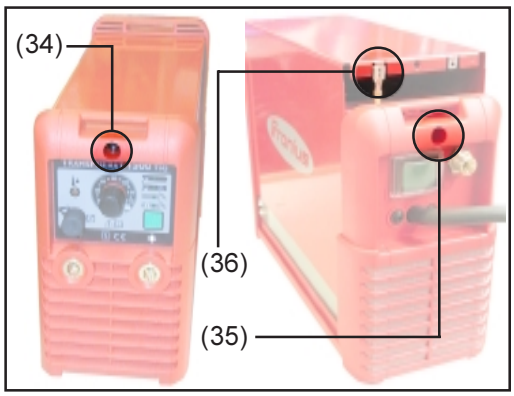


Fig.1

- Take off the carrying strap
- Undo the 5x25-TX20 screw (34) on the front of the housing
- Undo the 5x25-TX20 screw (35) on the rear of the housing
- Carefully lift the housing box and disconnect the “housing earth conductor” (36)

Opening the housing
(continued)

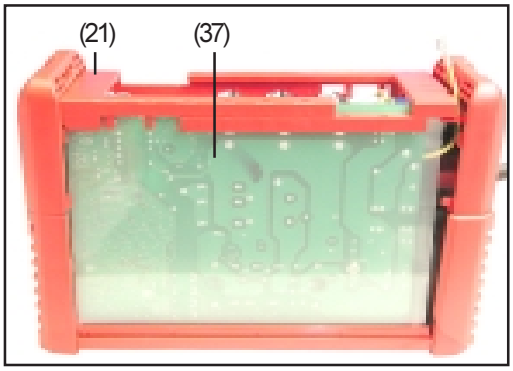


Fig.2

- Remove the housing stiffening element (21)
- Remove the board insulator (37)

Removing the LCA15 board

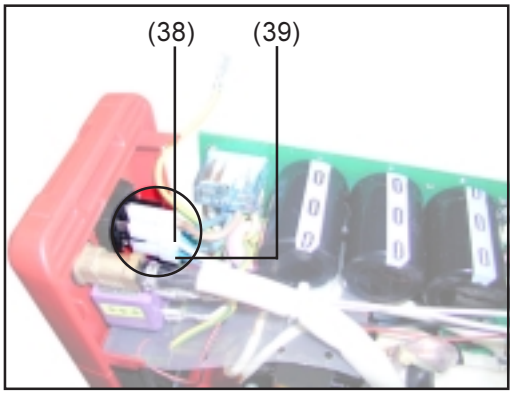


Fig.3

- Unplug the mains leads for the LCA15 board from the mains switch
  - L (white) from 1A (38)
  - N (blue) from 2A (39)

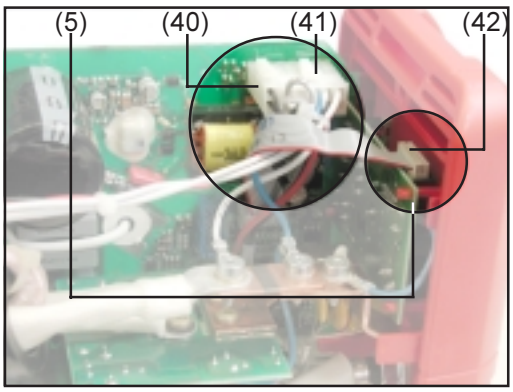


Fig.4

- Disconnect the ribbon cable (42) from the FPA15 board (5)
- Unplug the 2-pole Molex plug (40) from the LCA15 board
- Disconnect the 10-pole Molex plug (41) from the LCA15 board

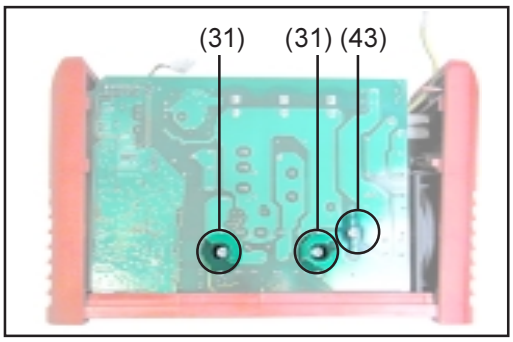


Fig.5

Note! Undo the two M4x14 screws (31) first, and only then undo the M4 screw (43)

- Undo the two M4x14-TX20 screws (31) (with cup springs) on the LCA15 board
- Undo the M4 screw (43) on the LCA15 board

Removing the LCA15 board
(continued)

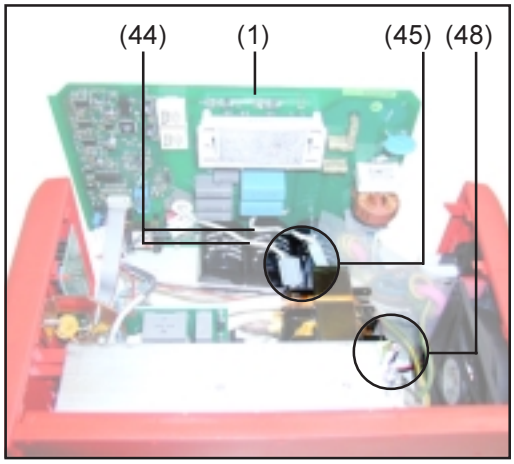


Fig.6

Note! When detaching the LCA15 board (1), make sure that you do not kink or pinch any cables, or subject them to tensile strain.

- Carefully detach the LCA15 board (1) from the heat sink

Note! When disconnecting the transformer leads (44) for the LCA15 board, squeeze the WAGO connectors (45) completely together.

- Disconnect the “LCA15 board transformer leads” (44)

Removing the transformer

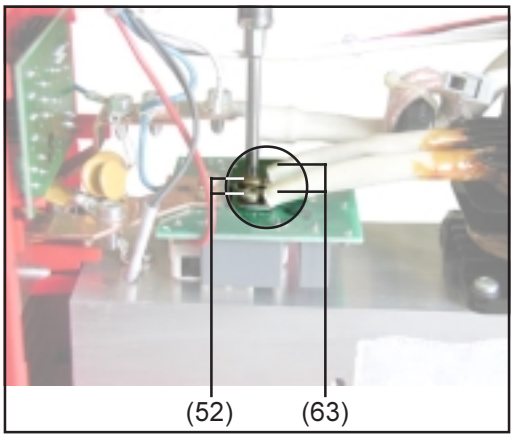


Fig.7

- Undo the M4x20 - TX20 screws (52) from the secondary-diode transformer leads (63)

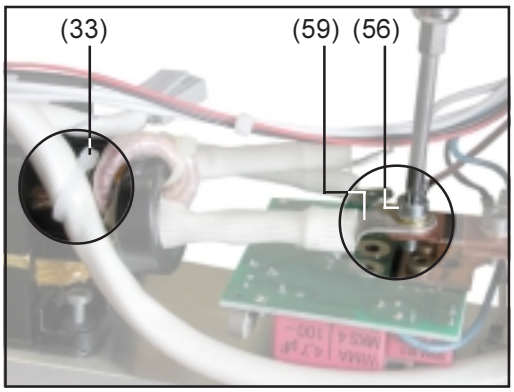


Fig.8

- TP 1500 TIG: Cut through the transformer / gas-hose cable binder (33)
- Undo the M5x12 - TX20 screw (56) from the centre-tap transformer lead (59)

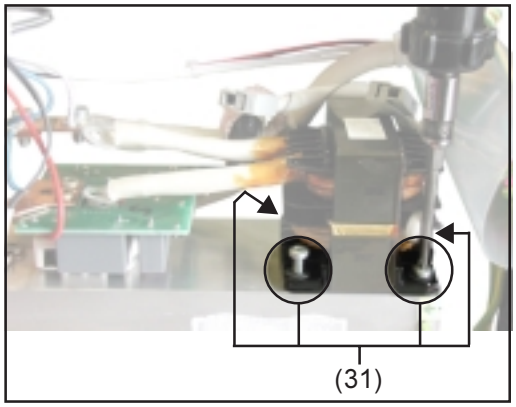


Fig.9

- Undo the four M4x14 - TX20 screws (31) on the transformer
- Remove the transformer

Fitting the transformer

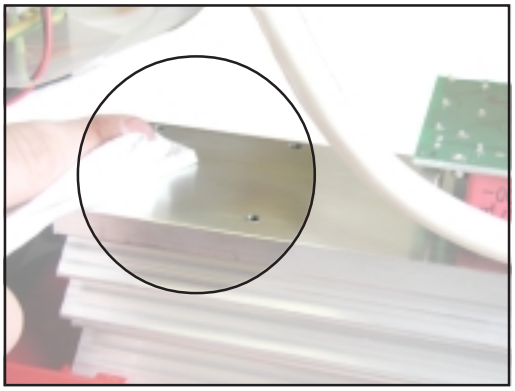


Fig.10

- Clean the heat sink with a dry and non-linting cloth

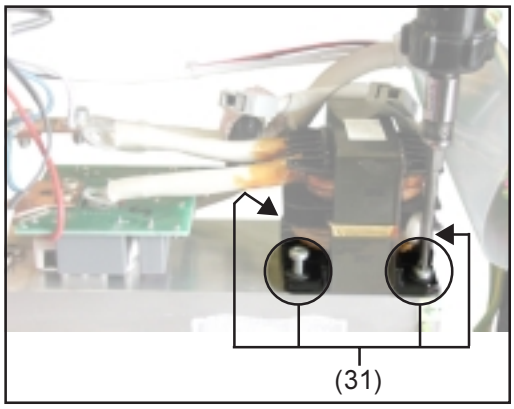


Fig.11

- Fasten the transformer in place by means of the four M4x14 - TX20 screws (31) on the transformer
  - Tighten the M4x14 - TX20 screws (31) with a torque of 2 Nm
- TP 1500 TIG: Fasten the transformer / gas-hose cable binder (33) (Fig.8)

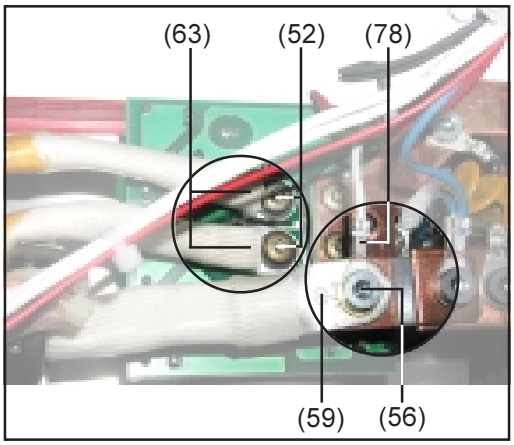


Fig.12

- Fasten the secondary-diode transformer leads (63) using two M4x20 - TX20 (52) screws

Make sure that the cable lugs of the “secondary-diode transformer leads” (63) are spaced as far apart as possible.

- Tighten the M4x20 - TX20 screws (52) with a torque of 1.5 Nm
- Fasten the centre-tap transformer lead (59) and the measuring lead (78) with the M5x12 - TX20 screw (56)
  - Tighten the M5x12 - TX20 screw (56) with a torque of 2 Nm

Fitting the LCA15 board

Fig.13

- Pre-clean the heat sink with contact spray and a non-linting cloth
- Remove any contamination or unevenness from the heat sink with fine abrasive paper (grain P 500 or finer)
- Clean the heat sink with contact spray and a non-linting cloth

Fitting the LCA15 board
(continued)

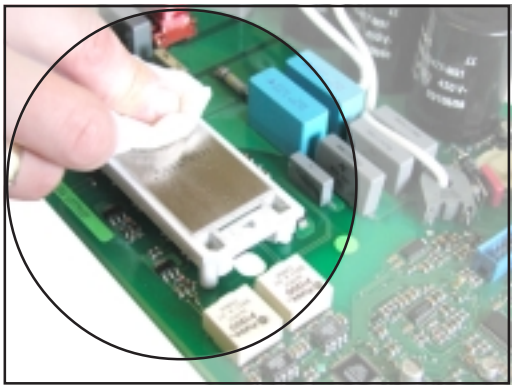


Fig.14

- Clean the underside of the transistor module with contact spray and a non-linting cloth

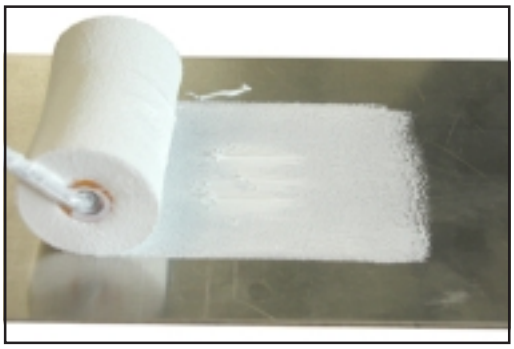


Fig.15

- Place a blob of heat-transfer compound on a flat, clean and smooth surface (e.g. coated wooden board)
- Using an application roller, spread the heat-transfer compound evenly across the surface
- Roll alternately from left to right until part of the surface is completely and evenly covered with heat-transfer compound

Fig.16

- Roll alternately at right angles to the previous direction until part of the surface is completely and evenly covered with heat-transfer compound
- Once there is an even, thin layer of compound on the roller of the application tool, lift the tool out of the compound

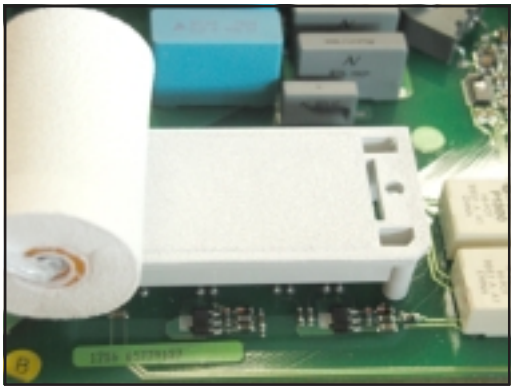


Fig.17

Note! If the heat-transfer compound is not applied to the component in a complete, gap-free layer, this may result in heat-transfer problems.

If too thick a layer of heat-transfer compound is applied, this also impairs heat transfer, and the transistor module may break when the fixing screws are tightened.

- Roll the compound approx. two or three times, until the underside of the transistor module is completely covered

Fitting the LCA15 board
(continued)

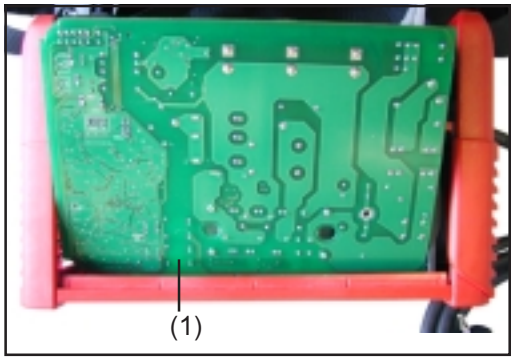


Fig.18

- Carefully place the LCA15 board (1), underside first, onto the heat sink

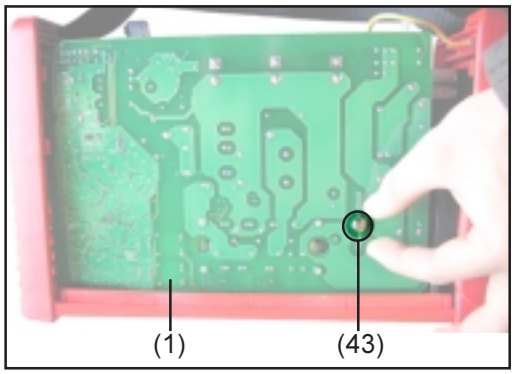


Fig.19

- To position the LCA15 board (1), gently screw the M4 screw (43) into the M4x17 earthing stud (48) - see Fig.10 - by hand.

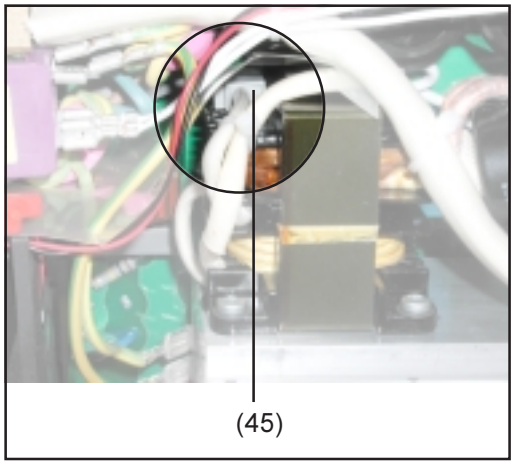


Fig.20a

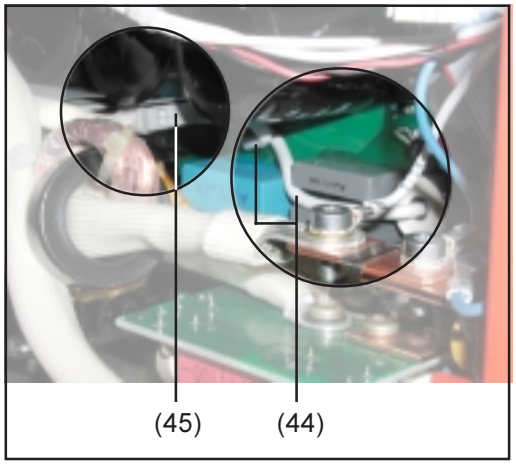


Fig.20b

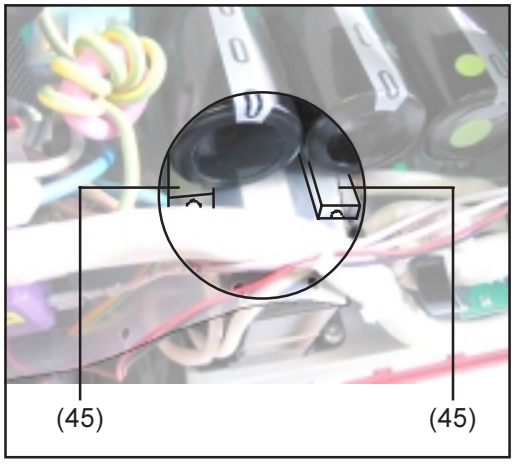


Fig.20c

- Arrange the transformer leads (44) for the LCA 15 board as shown in Fig.15, and stow away the WAGO connectors (45)

Fitting the LCA15 board
(continued)

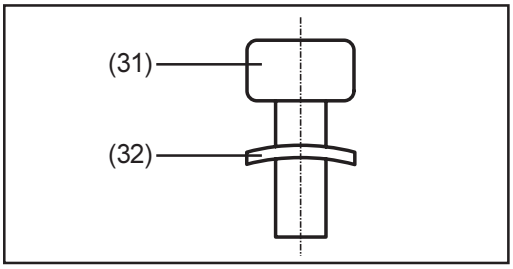


Fig.21

Note! Before inserting the M4x14-TX20 screws (31) into their holes, push the cup springs (32) onto the M4x14-TX20 screws (31), as shown in Fig.16.

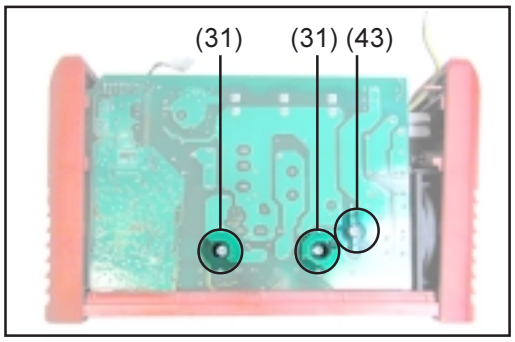


Fig.22

- Carefully turn the M4x14-TX20screws (31), alternately, until you start to feel gentle resistance

Note! Before you tighten the M4x14-TX20 screws (31), the transistor module must be lying completely flat on the heat sink, without any gaps.

- Pre-mount the M4x14-TX20 screws (31) with a torque of 0.6 Nm
- Tighten the M4x14-TX20 screws (31) with a torque of 2 Nm
- Tighten the M4 screw (43) with a torque of 1.5 Nm

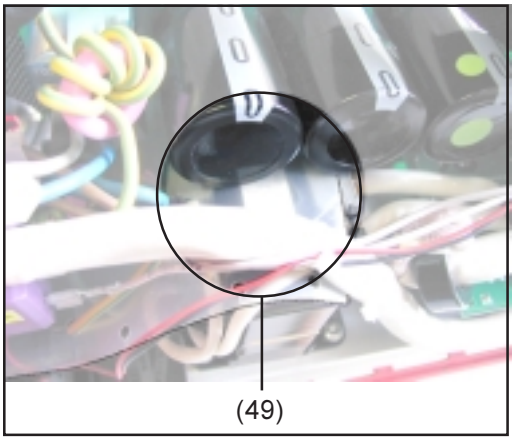


Fig.23

Note! Make sure that the air-guide film (49) is in the correct position.

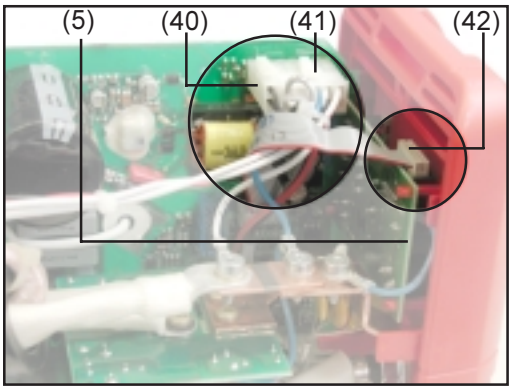


Fig.24

- Plug the 10-pole Molex plug (41) onto board LCA15
- Plug the 2-pole Molex plug (40) onto board LCA15

Note! Before plugging in the ribbon cable (42), pass it across the cable harness for Molex plugs (40) and (41), as shown in Fig. 19.

- Arrange the ribbon cable (42) above the cable harness, as shown in Fig.19
- Plug the ribbon cable (42) to board FPA15 (5)

Fitting the LCA15 board
(continued)

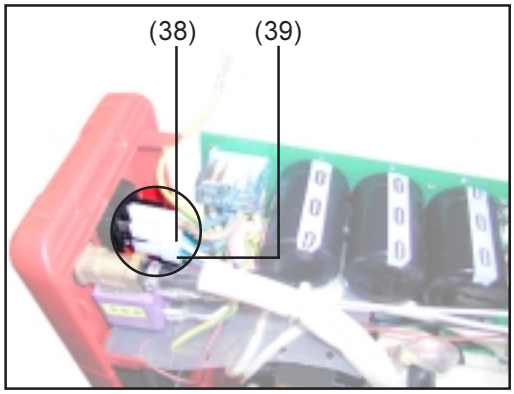


Fig.25

- Plug the mains leads for the LCA15 board back onto the mains switch
  - L (white) (38) to 1A
  - N (blue) (39) to 2A

Closing the housing

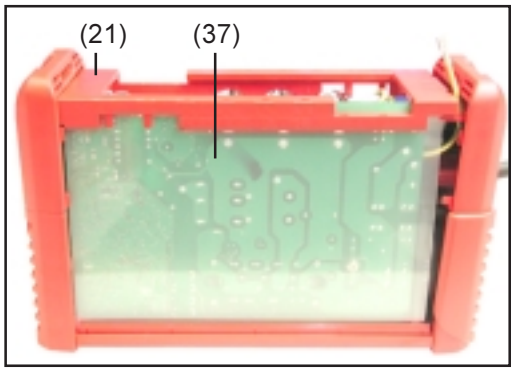


Fig.26

- Insert the board insulator (37)
- Insert the housing stiffening element (21)

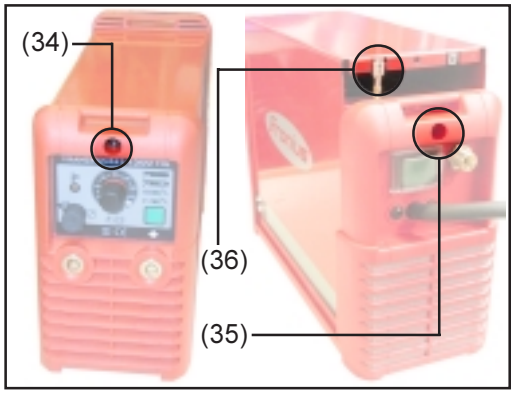


Fig.27

- Plug the “housing earth conductor” (36) onto the housing box, in the correct position
- Replace the housing box
- Screw the 5x25-TX20 screw (35) back onto the rear of the housing
- Screw the 5x25-TX20 screw (34) back onto the front of the housing
- Fit the carrying strap back on again

Installation instructions: Temperature sensor

GB

Safety

Warning! Work performed incorrectly can cause serious injury and damage. This modification may only be performed by suitably trained and skilled electricians! Before opening up the machine, shift the mains switch to the "0" position and unplug the machine from the mains!

Note! Follow the safety rules given in the Operating Instructions, especially the section headed "Safety inspection".

Scope of supply

The assembly “Temperature sensor“ (43,0001,1084) comprises the following component:

Item	Designation	N° of items
(9)	Temperature sensor	1

Tools needed

Designation

- Manual torque screwdriver (1 to 6 Nm, 42,0411,0013)
- Bit insert TX 20, for torque screwdriver

Opening the housing

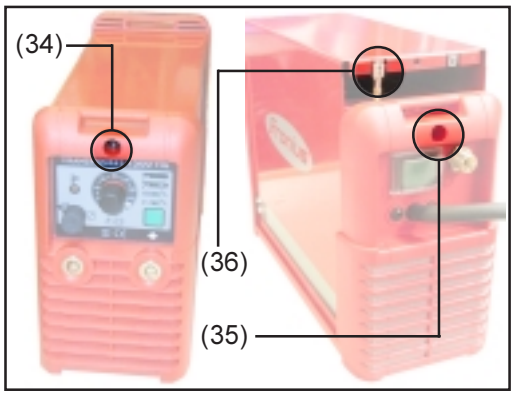


Fig.1

- Take off the carrying strap
- Undo the 5x25-TX20 screw (34) on the front of the housing
- Undo the 5x25-TX20 screw (35) on the rear of the housing
- Carefully lift the housing box and disconnect the “housing earth conductor” (36)

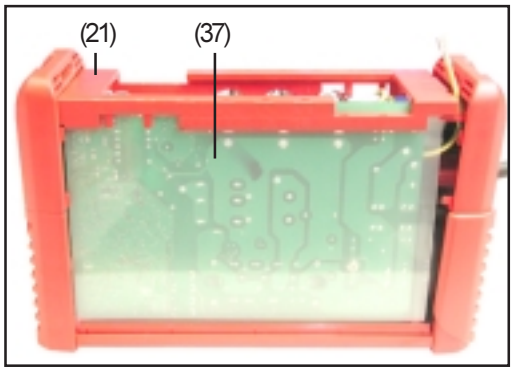


Fig.2

- Remove the housing stiffening element (21)
- Remove the board insulator (37)

Removing the temperature sensor

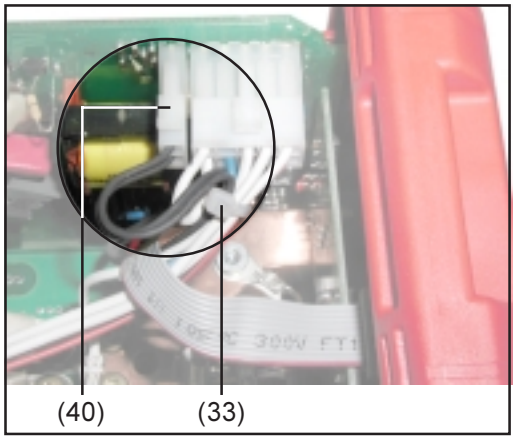


Fig.3

- Cut through the cable binder (33)
- Unplug the 2-pole Molex plug (40) from the LCA15 board

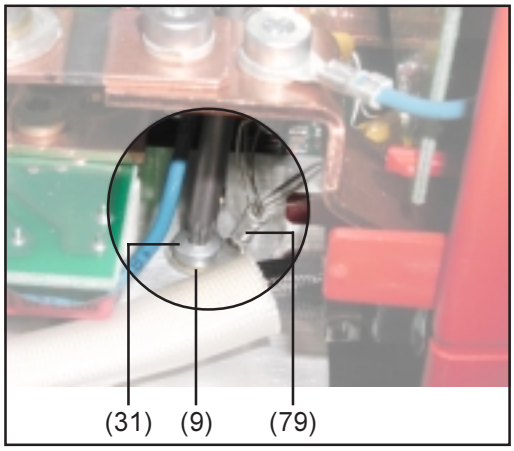


Fig.4

- Undo the M4x14-TX20 screw (31)
- Detach the temperature sensor (9)

Fitting the temperature sensor

- Mount the temperature sensor (9) and the suppressor circuit (79) using a M4x14-TX20 screw (31)
- Tighten the M4x14-TX20 screw (31) with a torque of 2 Nm (Fig.4)

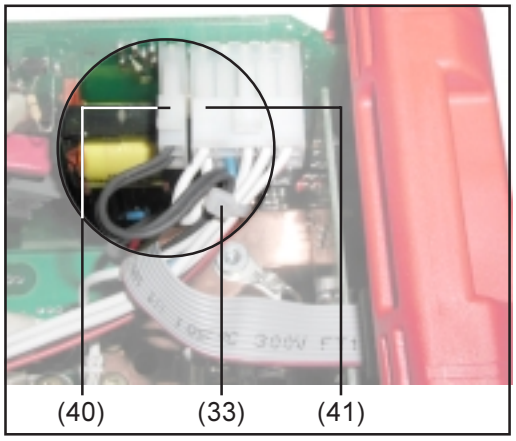


Fig.5

- Plug the 2-pole Molex plug (40) onto the LCA15 board
- Fix the cable harness for the 2-pole Molex plug (40) and the 10-pole Molex plug (41) with the cable binder (33)

Closing the housing

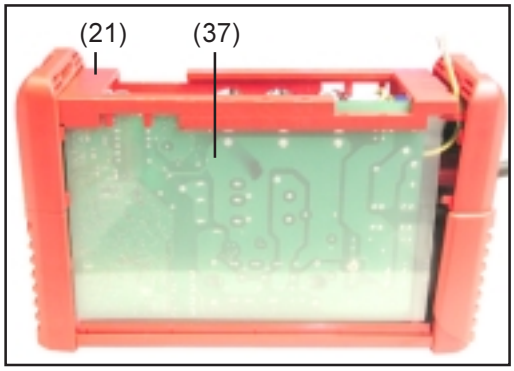


Fig.6

- Insert the board insulator (37)
- Insert the housing stiffening element (21)

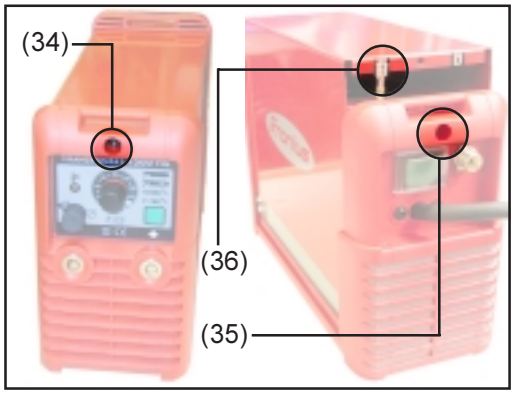


Fig.7

- Plug the “housing earth conductor” (36) onto the housing box, in the correct position
- Replace the housing box
- Screw the 5x25-TX20 screw (35) back onto the rear of the housing
- Screw the 5x25-TX20 screw (34) back onto the front of the housing
- Fit the carrying strap back on again

Installation instructions: Fan

Safety

Warning! Work performed incorrectly can cause serious injury and damage. This modification may only be performed by suitably trained and skilled electricians! Before opening up the machine, shift the mains switch to the "0" position and unplug the machine from the mains!

Note! Follow the safety rules given in the Operating Instructions, especially the section headed "Safety inspection".

Scope of supply

The assembly “Fan“ (43,0006,0177) comprises the following component:

Item	Designation	N° of items
(10)	Fan	1

Tools needed

Designation

- Molex extractor tool (42,0410,0290)

Opening the housing

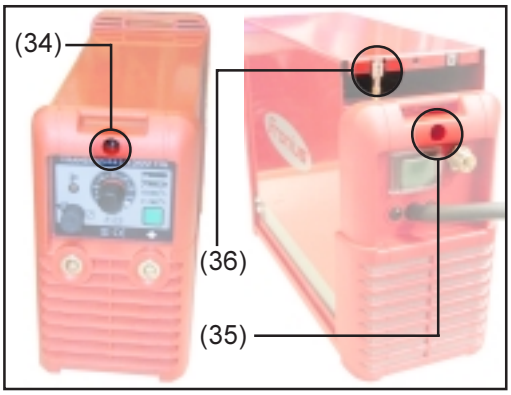


Fig.1

- Take off the carrying strap
- Undo the 5x25-TX20 screw (34) on the front of the housing
- Undo the 5x25-TX20 screw (35) on the rear of the housing
- Carefully lift the housing box and disconnect the “housing earth conductor” (36)

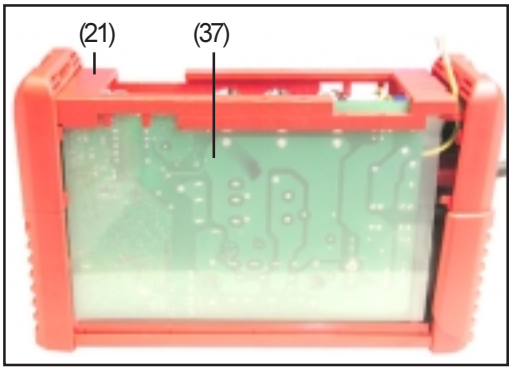


Fig.2

- Remove the housing stiffening element (21)
- Remove the board insulator (37)

Removing the fan

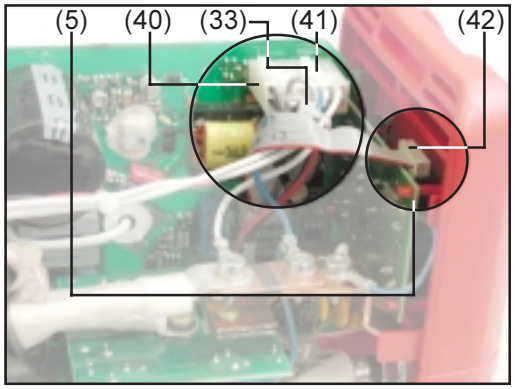


Fig.3

- Disconnect the ribbon cable (42) from the FPA15 board (5)
- Cut through the cable binder (33)
- Unplug the 2-pole Molex plug (40) from the LCA15 board
- Disconnect the 10-pole Molex plug (41) from the LCA15 board

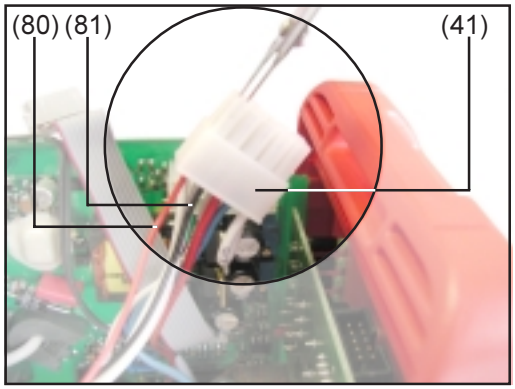


Fig.4

- Remove the following cables from the 10-pole Molex plug (41):
  - Fan lead, red (80), Pin 1
  - Fan lead, black (81), Pin 2

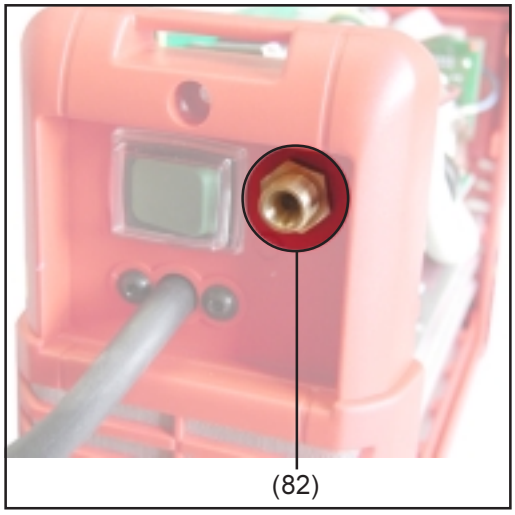


Fig.5

- TP 1500 TIG: Loosen the hexagon nut (82) - width-across 17 - on the gas connector

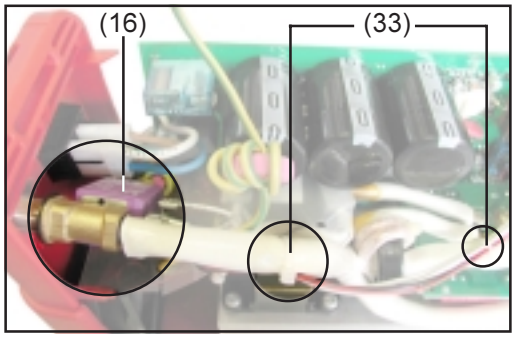


Fig.6

- Cut through the cable binder (33)
- TP 1500 TIG: Pivot the gas solenoid valve (16) to one side (Fig.6)

Removing the fan
(continued)

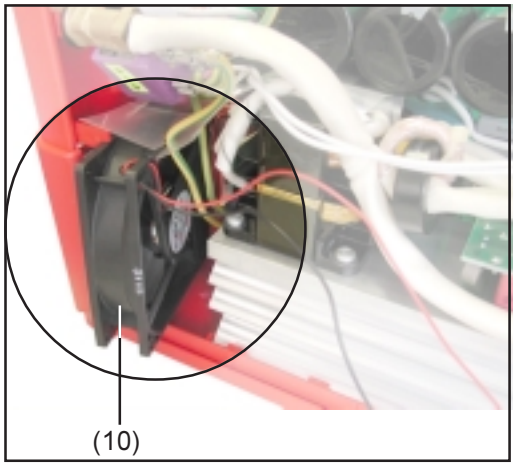


Fig.7

- Lift the fan (10) slightly and carefully pull it out to the side

Fitting the fan

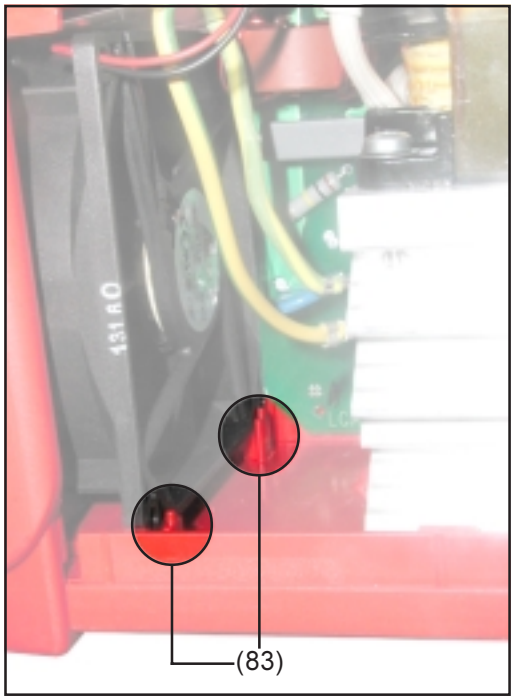


Fig.8

Note! When inserting the fan, make sure that it snaps into the catches (83).

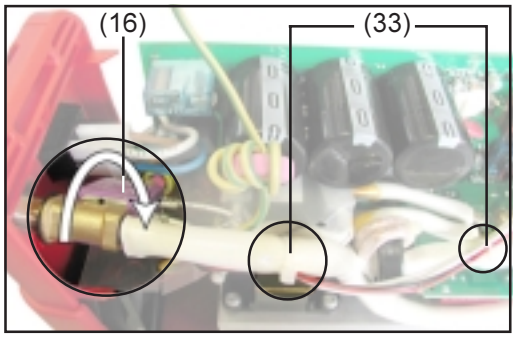


Fig.9

- TP 1500 TIG: Pivot the gas solenoid valve (16) back into its original position
- Fix the cables with cable binders (33)

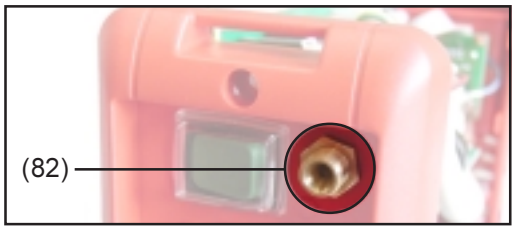


Fig.10

- TP 1500 TIG: Screw the hexagon nut (82) - width-across 17 - tightly to the gas connector

Fitting the fan
(continued)

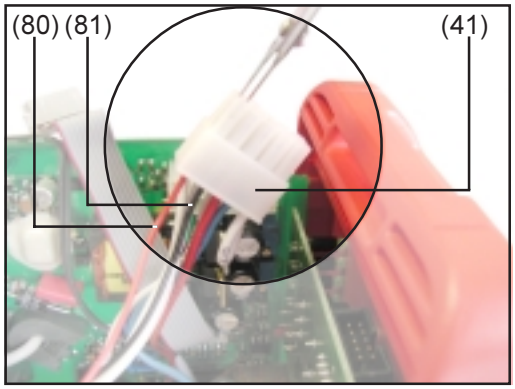


Fig.11

- Insert the following cables into the 10-pole Molex plug (41):
  - Fan lead, red (80), Pin 1
  - Fan lead, black (81), Pin 2

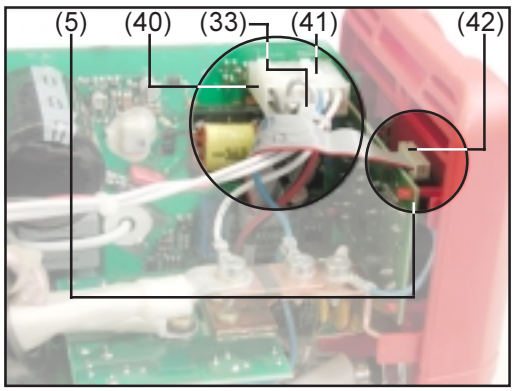


Fig.12

- Plug the 10-pole Molex plug (41) onto board LCA15
- Plug the 2-pole Molex plug (40) onto board LCA15
- Fix the cable harness for 2-pole Molex plug (40) and 10-pole Molex plug (41) with a cable binder.

Note! Before plugging in the ribbon cable (42), pass it across the cable harness for Molex plugs (40) and (41), as shown in Fig. 12.

- Arrange the ribbon cable (42) above the cable harness, as shown in Fig.12
- Plug the ribbon cable (42) to board FPA15 (5)

Closing the housing

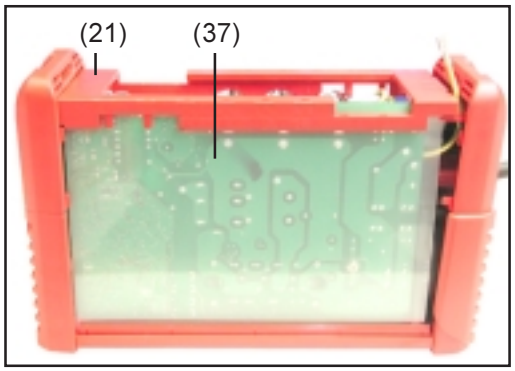


Fig.13

- Insert the board insulator (37)
- Insert the housing stiffening element (21)

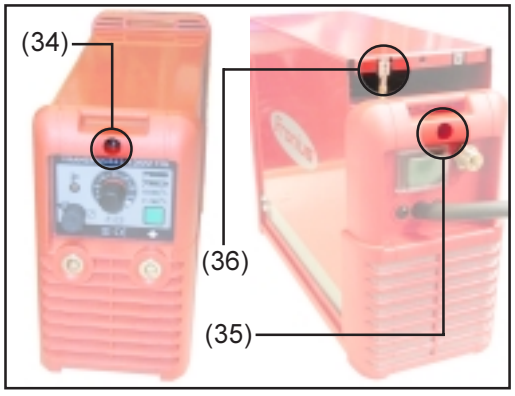


Fig.14

- Plug the “housing earth conductor” (36) onto the housing box, in the correct position
- Replace the housing box
- Screw the 5x25-TX20 screw (35) back onto the rear of the housing
- Screw the 5x25-TX20 screw (34) back onto the front of the housing
- Fit the carrying strap back on again

Installation instructions: Mains switch and mains cable

Safety

Warning! Work performed incorrectly can cause serious injury and damage. This modification may only be performed by suitably trained and skilled electricians! Before opening up the machine, shift the mains switch to the "0" position and unplug the machine from the mains!

Note! Follow the safety rules given in the Operating Instructions, especially the section headed "Safety inspection".

General remarks

These installation instructions apply to both the mains switch and the mains cable. If the mains switch is to be dismounted, but not the mains cable, the following sections may be omitted:
- “Removing the mains cable”
- “Mounting the mains cable”

If the mains cable is to be dismounted, but not the mains switch, the following sections may be omitted:
- “Removing the mains switch”
- “Fitting the mains switch”

Scope of supply

The assembly “Mains cable“ (43,0004,2133) comprises the following component:

Item	Designation	N° of items
(11)	Mains cable	1

The assembly “Mains switch” (43,0002,0295) comprises the following component:

Item	Designation	N° of items
(12)	Mains switch	1

Tools needed

Designation
- Manual torque screwdriver (1 to 6 Nm, 42,0411,0013)
- Bit insert TX 20, for torque screwdriver

Opening the housing

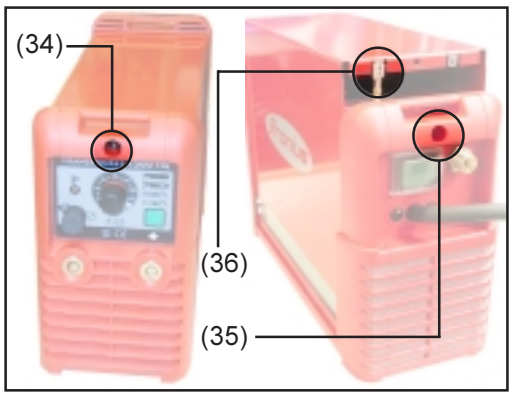


Fig.1

- Take off the carrying strap
- Undo the 5x25-TX20 screw (34) on the front of the housing
- Undo the 5x25-TX20 screw (35) on the rear of the housing
- Carefully lift the housing box and disconnect the “housing earth conductor” (36)

Opening the housing
(continued)

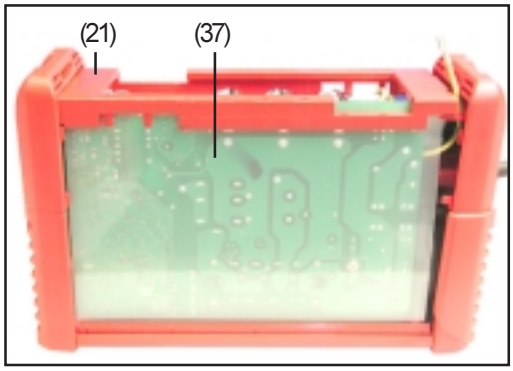


Fig.2

- Remove the housing stiffening element (21)
- Remove the board insulator (37)

Unplugging the mains leads

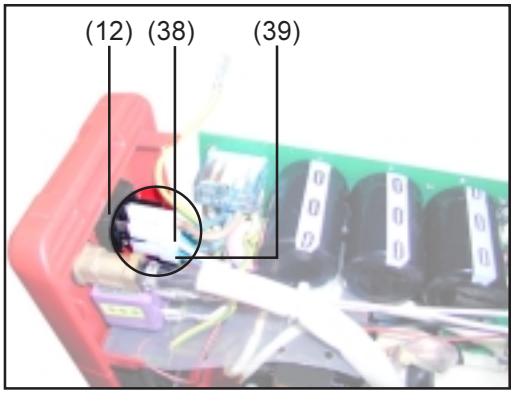


Fig.3

- Unplug the mains leads for the LCA15 board from the mains switch
  - L (white) from 1A (38)
  - N (blue) from 2A (39)

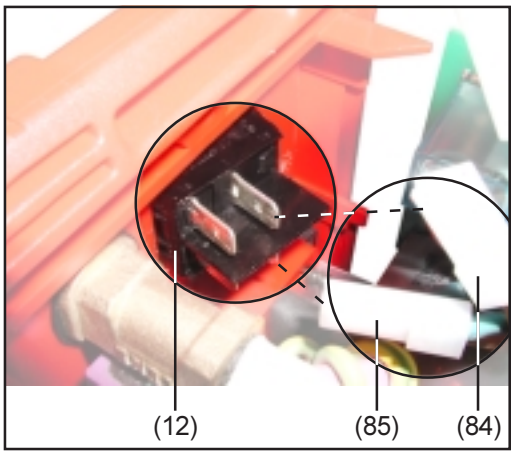


Fig.4

- Unplug the mains leads for the mains cable from the mains switch
  - L - brown (84) from 1
  - N - blue (85) from 2

Removing the mains switch

- Press in the catch on the side of the mains switch (12) and prise out the mains switch (12) (Fig.4)

Removing the mains cable

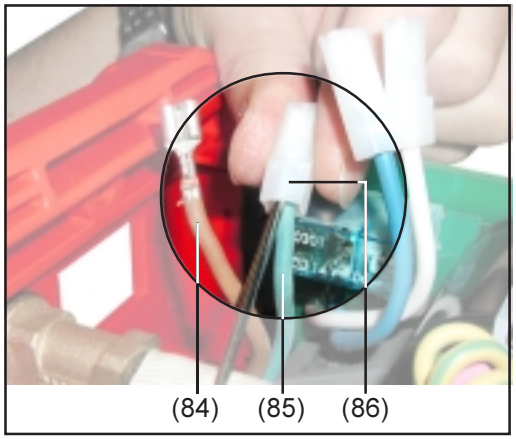


Fig.5

- On the mains leads L - brown (84) and N - blue (85), detach the insulating sleeves (86) from the flat-pin plugs
  - Insert a small screwdriver on the step-shaped side of an insulating sleeve and prise off the sleeve

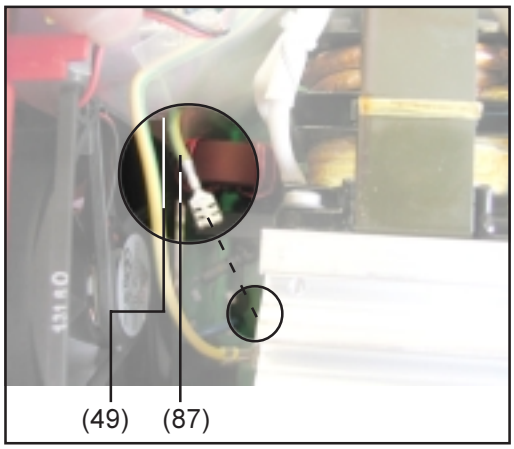


Fig.6

- On the heat sink, disconnect the mains-cable earthing conductor (87) and detach it from the air-guide film (49)

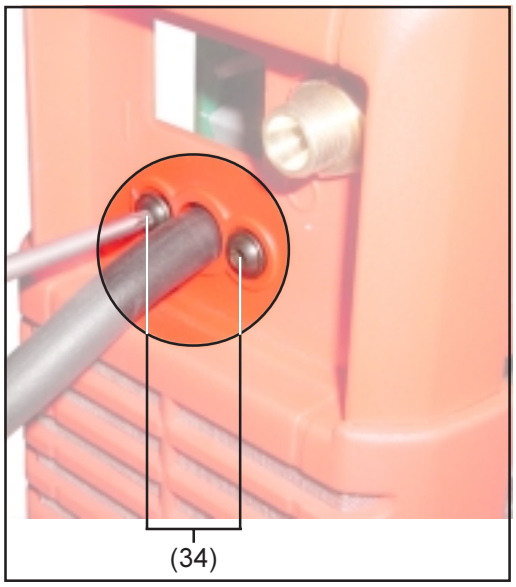


Fig.7

- At the rear of the machine, loosen the M5x25 - TX20 screws (34) for the mains-cable strain relief device

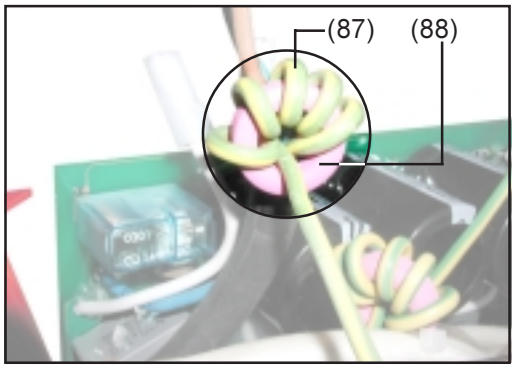


Fig.8

- Push the mains cable a short way into the housing
- Unwind the mains-cable earthing conductor (87) from the ferrite core (88)
- Pull the mains cable out of the housing

Mounting the mains cable

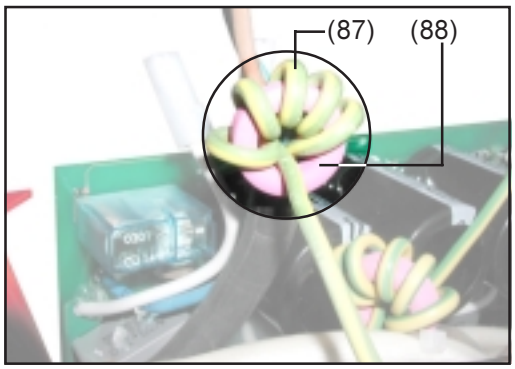


Fig.9

- Push the mains cable into the housing
- Wind the mains-cable earthing conductor (87) onto the ferrite core (88), with 5 windings
- Carefully pull the mains cable a short way out of the housing, until the ferrite core (88) with the wound-on earthing conductor (87) can be stowed away well

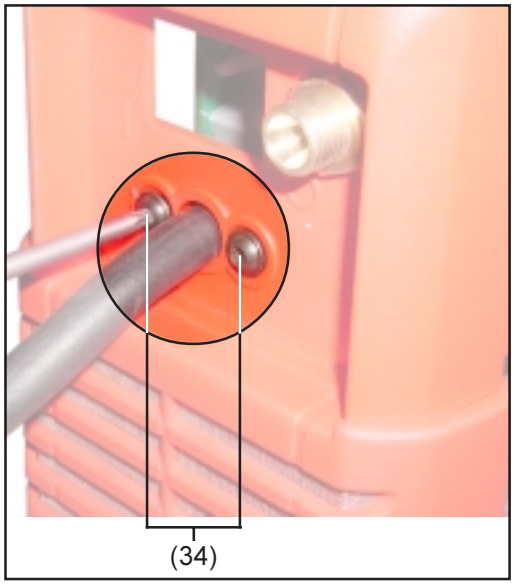


Fig.10

- At the rear of the machine, tighten the M5x25 - TX20 screws (34) for the mains-cable strain relief device with a torque of 1.5 Nm

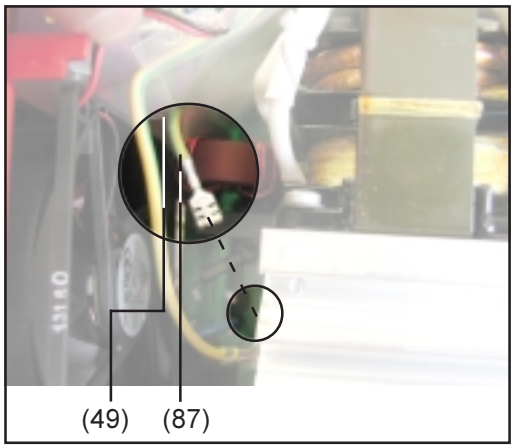


Fig.11

- Thread the mains-cable earthing conductor (87) through the air-guide film (49) and plug it onto the heat sink

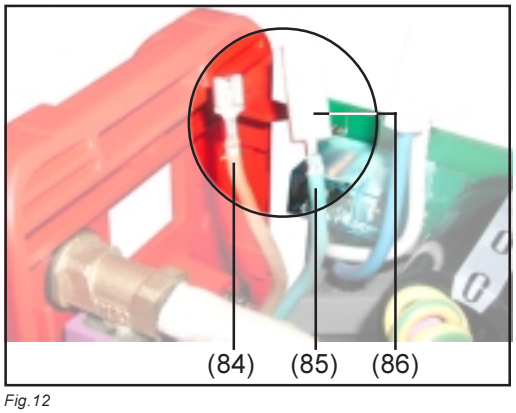


Fig.12

- On the mains leads L - brown (84) and N - blue (85), push the insulating sleeves (86) onto the flat-pin plugs

Fitting the mains switch

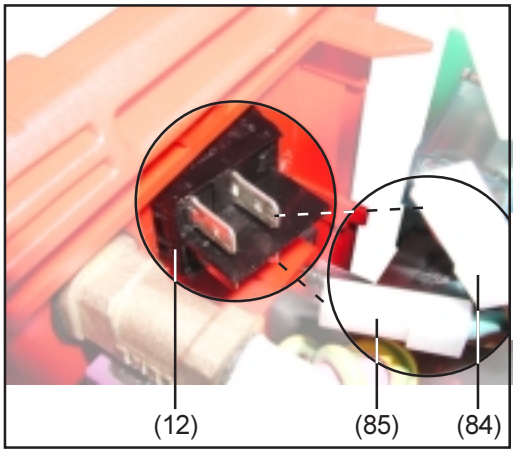


Fig.13

- Working from the outside, insert the mains switch (12) into the rear of the housing and press it in until it snaps into the catches

Plugging on the mains leads

- On the mains switch (12), plug on the mains leads for the mains cable (Fig.13)
  - L - brown (84) to 1
  - N - blue (85) to 2

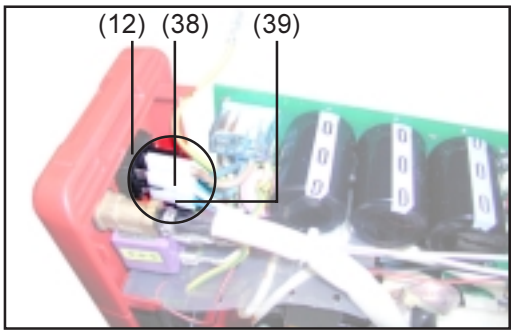


Fig.14

- On the mains switch (12), plug on the mains leads for the LCA15 board
  - L - white (38) to 1A
  - N - blue (39) to 2A

Closing the housing

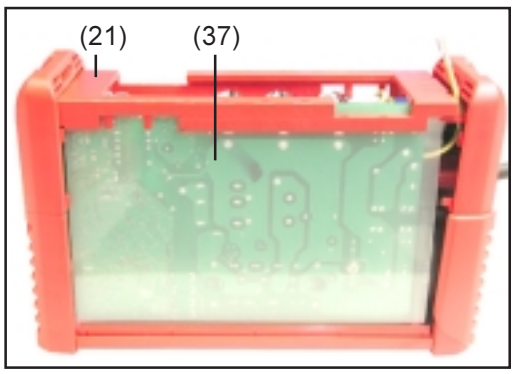


Fig.15

- Remove the board insulator (37)
- Remove the housing stiffening element (21)

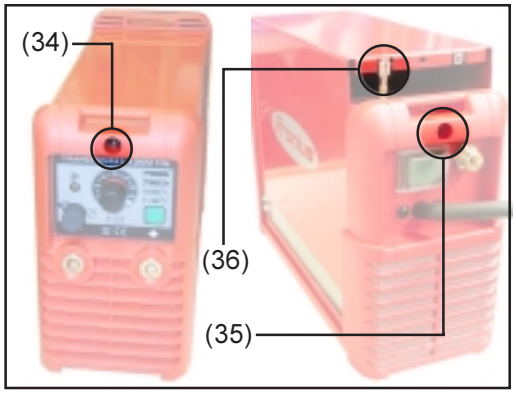


Fig.16

- Plug the “housing earth conductor” (36) onto the housing box, in the correct position
- Replace the housing box
- Screw the 5x25-TX20 screw (35) back onto the rear of the housing
- Screw the 5x25-TX20 screw (34) back onto the front of the housing
- Fit the carrying strap back on again

Installation instructions: Gas solenoid valve

Safety

Warning! Work performed incorrectly can cause serious injury and damage. This modification may only be performed by suitably trained and skilled electricians! Before opening up the machine, shift the mains switch to the "0" position and unplug the machine from the mains!

Note! Follow the safety rules given in the Operating Instructions, especially the section headed "Safety inspection".

Scope of supply

The assembly “Gas solenoid valve“ (43,0013,0021) comprises the following component:

Item	Designation	N° of items
(16)	Gas solenoid valve	1

The assembly “hose clamp” (43,0407,0273) comprises the following component:

Item	Designation	N° of items
(18)	Hose clamp	1

Opening the housing

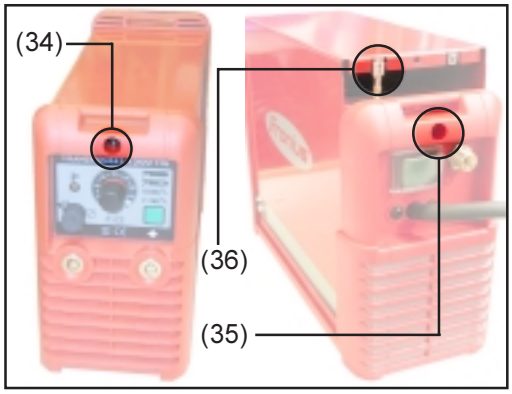


Fig.1

- Take off the carrying strap
- Undo the 5x25-TX20 screw (34) on the front of the housing
- Undo the 5x25-TX20 screw (35) on the rear of the housing
- Carefully lift the housing box and disconnect the “housing earth conductor” (36)

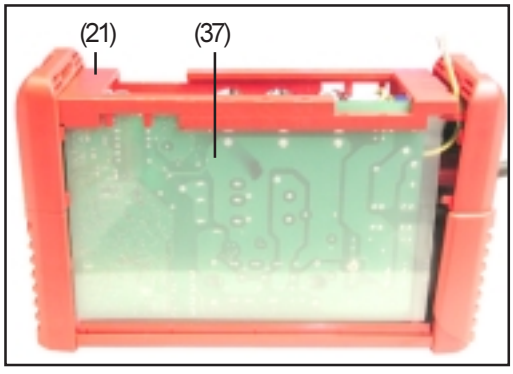


Fig.2

- Remove the housing stiffening element (21)
- Remove the board insulator (37)

Removing the gas solenoid valve

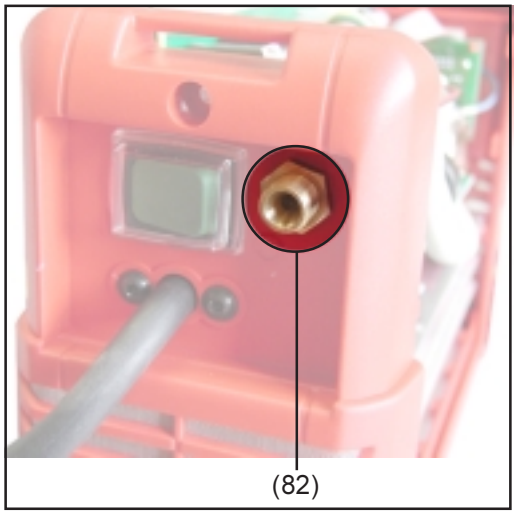


Fig.3

- TP 1500 TIG: Undo the hexagon nut (82) - width-across 17 - on the gas connector

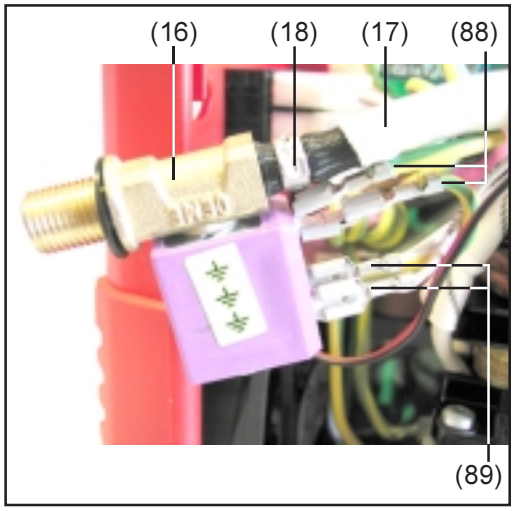


Fig.4

- Take out the gas solenoid valve (16) from the rear of the housing
- Open the hose clamp (18) and take out the gas hose (17)
- Disconnect the 2 earthing conductors (88)
- Disconnect the 2 “Gas value” control leads (89)

Fitting the gas solenoid valve

Note! Use a new hose clamp (18) to fasten the gas hose (17)

- Push the gas hose (17) onto the magnet valve and fasten it with a hose clamp (18)
- Connect up the earthing conductors (88)

Note! When connecting the “Gas value” control lines (89), there is no need to ensure any particular polarity.

- Connect the “Gas value” control lines (89)
- Insert the gas solenoid valve (16) in the rear of the housing

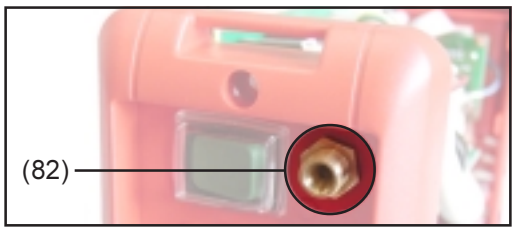


Fig.5

- TP 1500 TIG: Tighten the hexagon nut (82) - width-across 17 - to the gas connector

Closing the housing

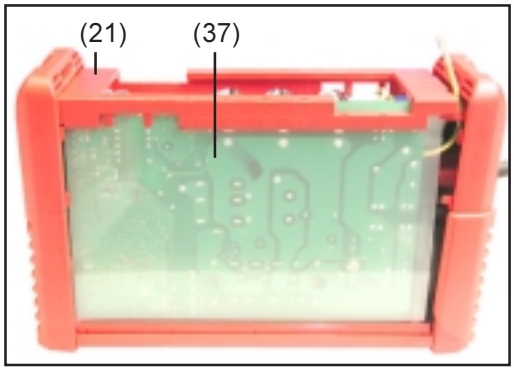


Fig.6

- Remove the board insulator (37)
- Remove the housing stiffening element (21)

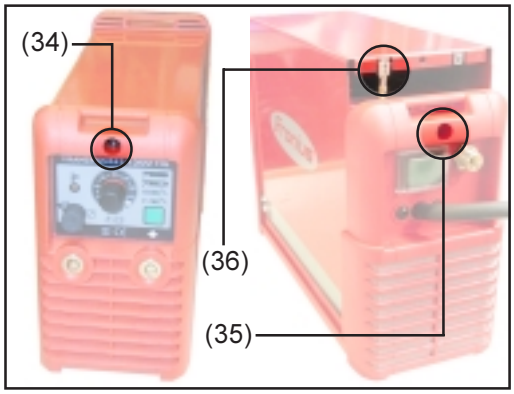


Fig.7

- Plug the “housing earth conductor” (36) onto the housing box, in the correct position
- Replace the housing box
- Screw the 5x25-TX20 screw (35) back onto the rear of the housing
- Screw the 5x25-TX20 screw (34) back onto the front of the housing
- Fit the carrying strap back on again

Installation instructions: Potentiometer, connection socket + seal for remote control unit

Safety

Warning! Work performed incorrectly can cause serious injury and damage. This modification may only be performed by suitably trained and skilled electricians! Before opening up the machine, shift the mains switch to the "0" position and unplug the machine from the mains!

Note! Follow the safety rules given in the Operating Instructions, especially the section headed "Safety inspection".

General remarks

These installation instructions describe the entire procedure for removing and fitting the FPA15 board, complete with potentiometer, connection socket for the remote control unit, and seal for the connection socket.

If you intend to replace either the potentiometer, the remote-control unit connection socket or the seal for the remote-control unit connection socket separately, you must read and observe the sections headed “Removing the FPA15 board” and “Fitting the FPA15 board”.

Scope of supply

The assembly “Potentiometer” (41,0001,0632) comprises the following component:

Item	Designation	N° of items
(29)	Potentiometer	1

The assembly “Remote-control unit connection socket” (43,0003,0756) comprises the following component:

Item	Designation	N° of items
(30)	Remote-control unit connection socket	1

The assembly “Seal for remote-control unit connection socket” (42,0405,0302) comprises the following component:

Item		N° of items
(7)	Seal for remote-control unit connection socket	1

Tools needed

Designation

- Manual torque screwdriver (1 to 6 Nm, 42,0411,0013)
- Bit insert TX 20, for torque screwdriver

Additional needed tools

- Socket spanner holder with 1/4” external hexagonal-socket drive and 1/4” external square-socket drive, to fit torque screwdriver
- Socket spanner insert - width-across 7 - with 1/4” internal square-socket drive

Opening the housing

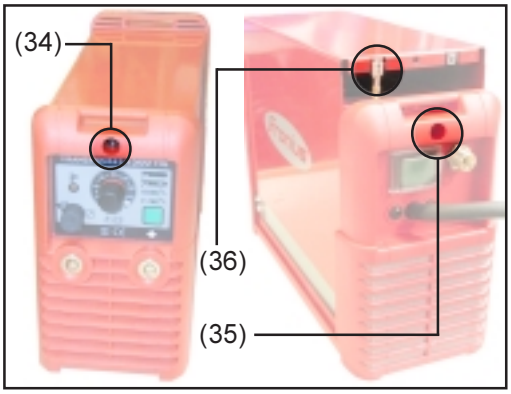


Fig.1

- Take off the carrying strap
- Undo the 5x25-TX20 screw (34) on the front of the housing
- Undo the 5x25-TX20 screw (35) on the rear of the housing
- Carefully lift the housing box and disconnect the “housing earth conductor” (36)

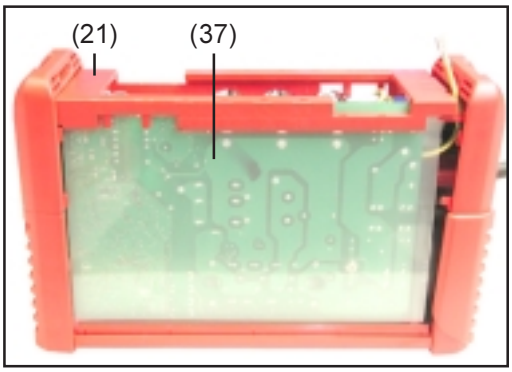


Fig.2

- Remove the housing stiffening element (21)
- Remove the board insulator (37)

Removing the FPA15 board

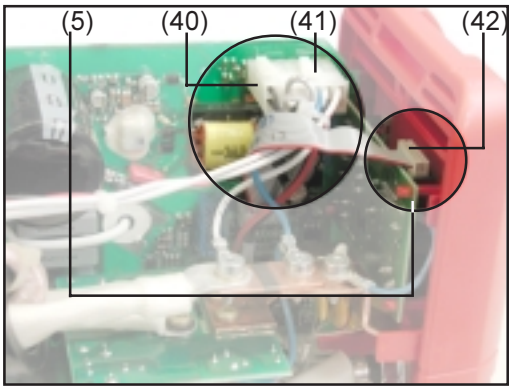


Fig.3

- Disconnect the ribbon cable (42) from the FPA15 board (5)
- Unplug the 2-pole Molex plug (40) from the LCA15 board
- Disconnect the 10-pole Molex plug (41) from the LCA15 board

Fig.4

- Take off the cap from the “Welding-amperage setting dial“ (6)

Note! When undoing the fixing nut for the “Welding-amperage setting dial“, hold the dial (6) firmly

- Undo the fixing nut of the setting dial (6) with the socket spanner (width-across 7)
- Detach the setting dial (6)

Removing the FPA15 board
(continued)

Fig.5

- Undo and remove the round nut (66)

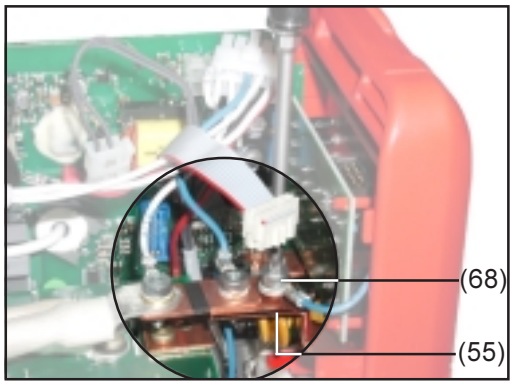


Fig.6

- Undo the M5x12 - TX20 screw (68) on the copper bracket (55)

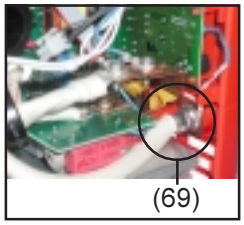


Fig.7

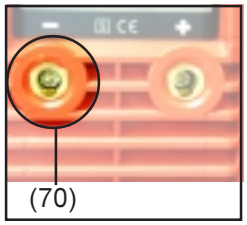


Fig.8

- **TP 1500 TIG:** Loosen the hexagon nut (69) (width-across=13) for the screw-fixing of the ⊖ socket
- **TP 1500 / 1500 RC:** In the ⊖ socket, loosen the M5x12 (TX20) screw (70)

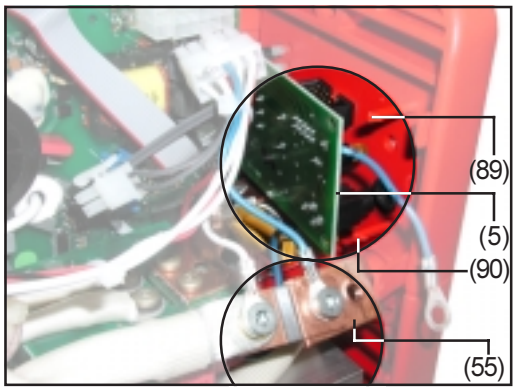


Fig.9

- Swing the copper bracket (55) to one side

Note! First carefully detach the FPA15 board (5) from the front alignment pins (89) and (90).

- Carefully lift the FPA15 board (5) and remove it

Removing the seal for the remote-control unit connection socket

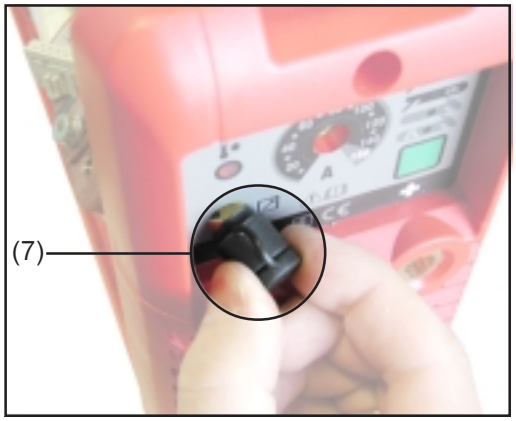


Fig.10

- Carefully pull the seal (7) for the remote-control unit connection socket out of the front of the housing

Removing the potentiometer and remote-control unit connection socket

Note! Never use force to detach the potentiometer (29) and the remote-control unit connection socket (30) from the LCA 15 board. Before any work involving the soldering iron, always clean the tip of the soldering iron.

- Solder on 5 soldering points (90) for the potentiometer
- Completely remove the solder from the soldering points (90), using a solder absorption strand or suction pump
- Carefully detach the potentiometer (29) from the FPA 15 board
- Solder on 4 soldering points (91) for the remote-control unit connection socket
- Completely remove the solder from the soldering points (91), using a solder absorption strand or suction pump
- Carefully detach the remote-control unit connection socket (30) from the FPA 15 board

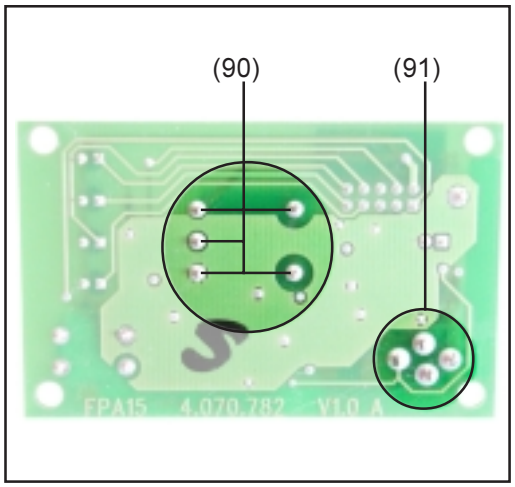


Fig.11

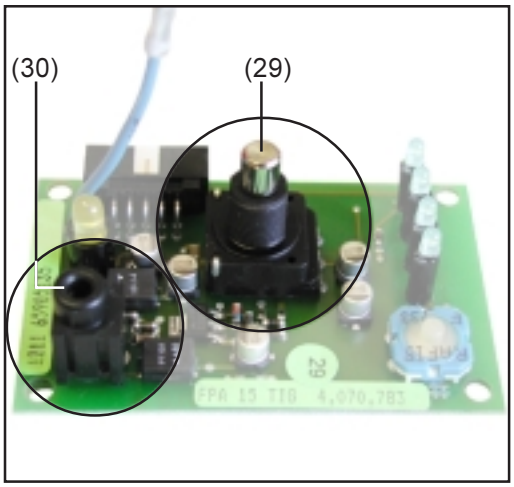


Fig.12

Fitting the potentiometer and remote-control unit connection socket

Note! Only use special electronics soldering tin for soldering-on the potentiometer (29) and the remote-control unit connection socket (30)

- Carefully insert the potentiometer (29) into the 5 soldering points (90)
- Solder the potentiometer (29) onto the 5 soldering points (90)
- Insert the remote-control unit connection socket (30) into the 4 soldering points (91)
- Solder the remote-control unit connection socket (30) onto the 4 soldering points (91)

Fitting the seal for the remote-control unit connection socket

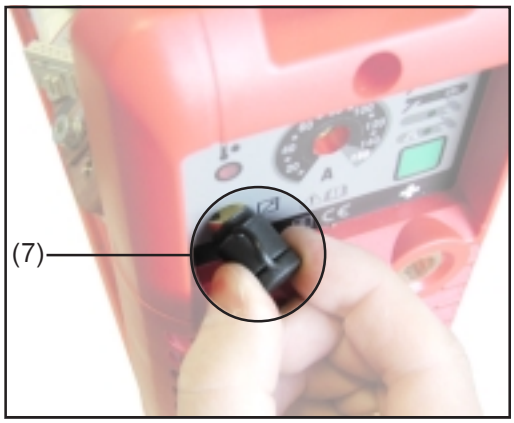


Fig.13

- Carefully insert the seal (7) for the remote-control unit connection socket into the front of the housing

Fitting the FPA15 board

Note! Before fixing the FPA15 board (5) on the alignment pins, do the following:

- TP 1500 RC / 1500 TIG: Apply a thin layer of lubricant to the seal of the remote-control socket (7) (Fig.13)
- TP 1500 RC / 1500 TIG: Apply gentle pressure to the seal of the remote-control socket (7), to prevent it being forced out when you press on the FPA15 board (Fig.14)
- Snap the FPA15 board (5) (Fig.9) onto the rear alignment pin first

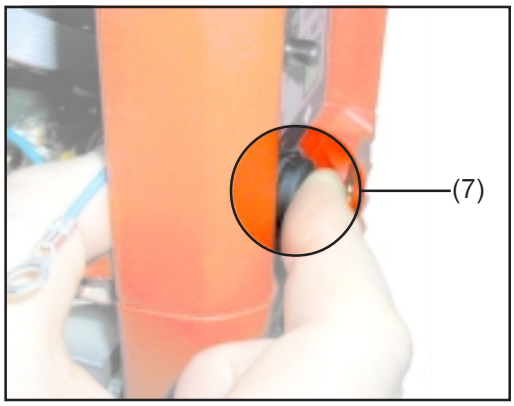


Fig.14

- Carefully press the FPA15 board until all the alignment pins have snapped into place

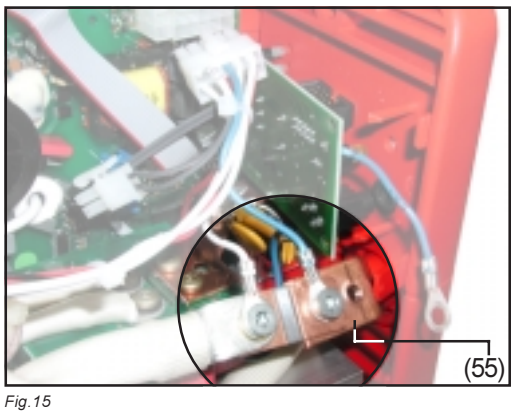


Fig.15

- Swing the copper bracket (55) back into its original position

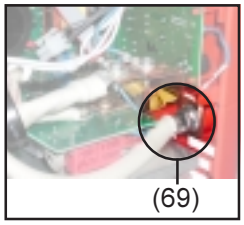


Fig.16

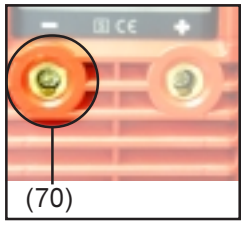


Fig.17

- **TP 1500 TIG:** Tighten the hexagon nut (69) (width-across=13) for the screw-fixing of the ⊖ socket
- **TP 1500 / 1500 RC:** In the ⊖ socket, tighten the M5x12 (TX20) screw (70) with a torque of 2 Nm.

Fitting the FPA15 board
(continued)

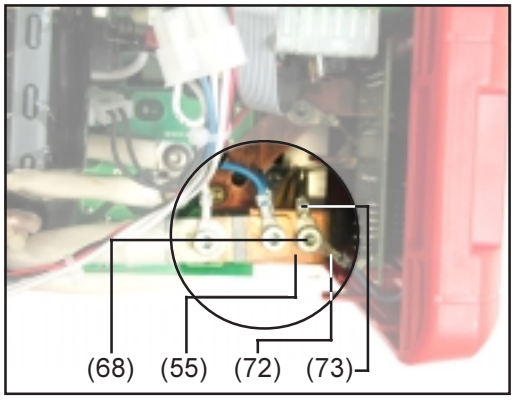


Fig.18

- Fasten the X3 cable (blue) (72) and the by-pass capacitors (73) onto the copper bracket (55), using the 5x12 - TX20 screw (68)
  - Tighten the 5x12 - TX20 screw (68) with a torque of 2 Nm

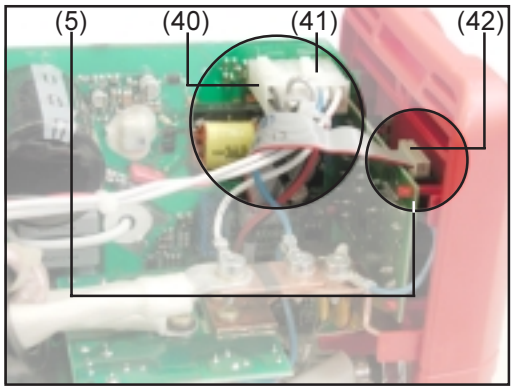


Fig.19

- Plug the 10-pole Molex plug (41) onto board LCA15
- Plug the 2-pole Molex plug (40) onto board LCA15
- Arrange the ribbon cable (42) above the cable harness, as shown in Fig.19
- Plug the ribbon cable (42) to board FPA15 (5)

Closing the housing

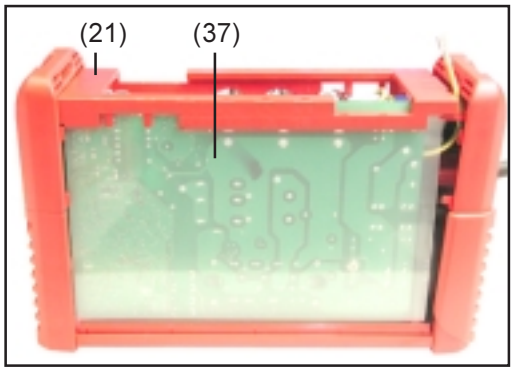


Fig.20

- Insert the board insulator (37)
- Insert the housing stiffening element (21)

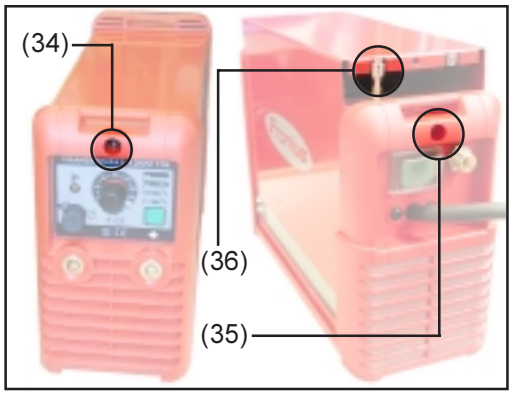


Fig.21

- Plug the “housing earth conductor” (36) onto the housing box, in the correct position
- Replace the housing box
- Screw the 5x25-TX20 screw (35) back onto the rear of the housing
- Screw the 5x25-TX20 screw (34) back onto the front of the housing
- Fit the carrying strap back on again

Installation instructions: Front of housing, with adhesive label and welding sockets

Safety

Warning! Work performed incorrectly can cause serious injury and damage. This modification may only be performed by suitably trained and skilled electricians! Before opening up the machine, shift the mains switch to the "0" position and unplug the machine from the mains!

Note! Follow the safety rules given in the Operating Instructions, especially the section headed "Safety inspection".

General remarks

These installation instructions describe the entire procedure for removing and fitting the front of the housing, complete with welding sockets and adhesive label. If you only intend to exchange the welding sockets, then it is only necessary to read and observe the sections headed “Removing the welding sockets” and “Fitting the welding sockets”.

As the front of the housing is supplied without welding sockets, the existing welding sockets must be re-used with the new front of the housing.

Scope of supply

The assembly “Front of housing” (12,0405,0297)” comprises the following component:

Item	Designation	N° of items
(23)	Front of housing	1

The assembly “Adhesive label” comprises the following components:

Item	Designation	N° of items
(26)	Adhesive label TP 1500 (42,0409,2839)	1
(27)	Adhesive label TP 1500 RC (42,0409,2840)	1
(28)	Adhesive label TP 1500 TIG (42,0409,2841)	1

The assembly “Welding socket” comprises the following components:

Item	Designation	N° of items
(13)	Minus welding socket TP 1500 TIG (42,0001,5346)	1
(14)	Welding socket (general) (42,0001,3070)	1

The assembly “Hose clamp” (43,0407,0273) comprises the following component:

Item	Designation	N° of items
(18)	Hose clamp	1

Tools needed

Designation

- Manual torque screwdriver (1 to 6 Nm, 42,0411,0013)
- Bit insert TX 20, for torque screwdriver

Opening the housing

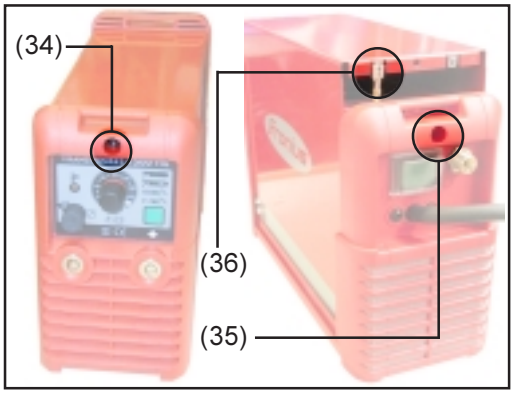


Fig.1

- Take off the carrying strap
- Undo the 5x25-TX20 screw (34) on the front of the housing
- Undo the 5x25-TX20 screw (35) on the rear of the housing
- Carefully lift the housing box and disconnect the “housing earth conductor” (36)

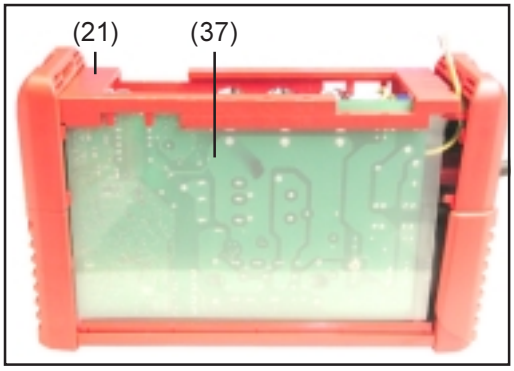


Fig.2

- Remove the housing stiffening element (21)
- Remove the board insulator (37)

Removing the FPA15 board

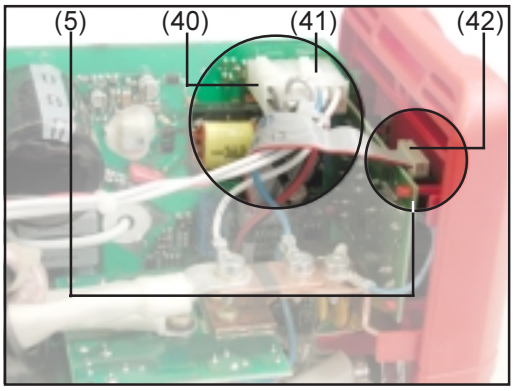


Fig.3

- Disconnect the ribbon cable (42) from the FPA15 board (5)
- Unplug the 2-pole Molex plug (40) from the LCA15 board
- Disconnect the 10-pole Molex plug (41) from the LCA15 board

Fig.4

- Take off the cap from the “Welding-amperage setting dial“ (6)

Note! When undoing the fixing nut for the “Welding-amperage setting dial“, hold the dial (6) firmly

- Undo the fixing nut of the setting dial (6) with the socket spanner (width-across 7)
- Detach the setting dial (6)

Removing the FPA15 board (continued)

Fig.5

- Undo and remove the round nut (66)

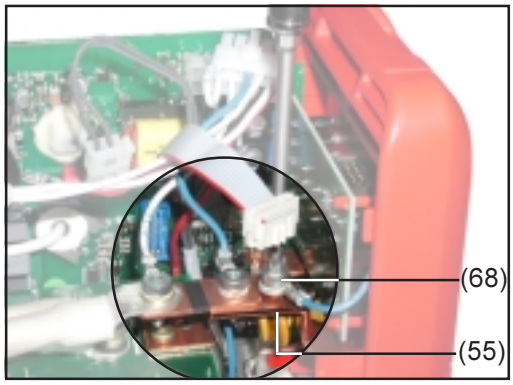


Fig.6

- Undo the M5x12 - TX20 screw (68) on the copper bracket (55)

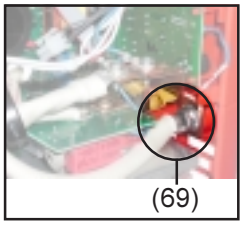


Fig.7

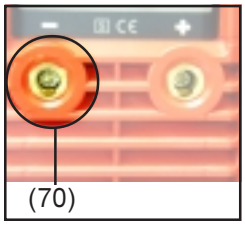


Fig.8

- **TP 1500 TIG:** Loosen the hexagon nut (69) (width-across=13) for the screw-fixing of the ⊖ socket
- **TP 1500 / 1500 RC:** In the ⊖ socket, loosen the M5x12 (TX20) screw (70)

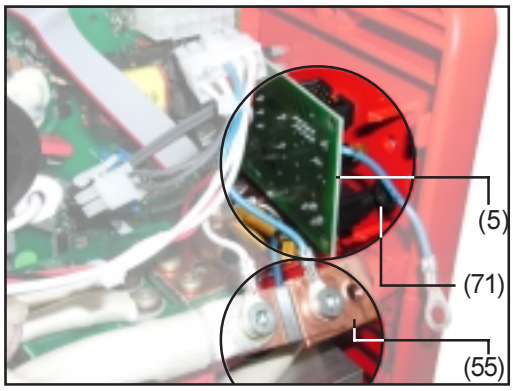


Fig.9

- Swing the copper bracket (55) to one side

Note! First carefully detach the FPA15 board (5) from the front alignment pins.

- Carefully lift the FPA15 board (5) and remove it

Removing the seal for the remote-control unit connection socket

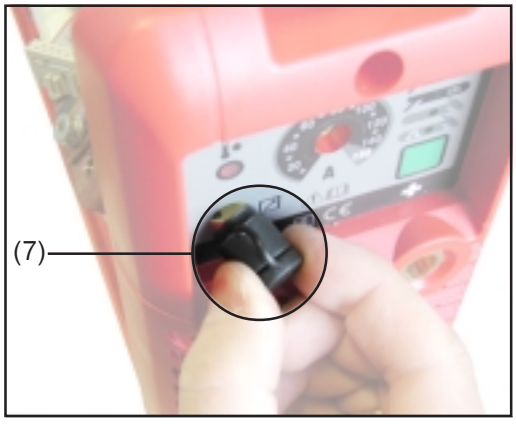


Fig.10

- Carefully pull the seal (7) for the remote-control unit connection socket out of the front of the housing

Removing the welding sockets

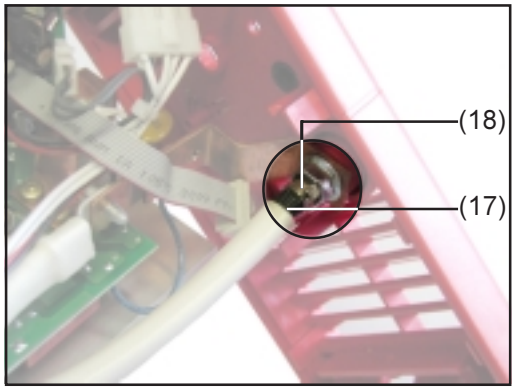


Fig.11

- **TP 1500 TIG:** Open the hose clamp (18) and take out the gas hose (17)

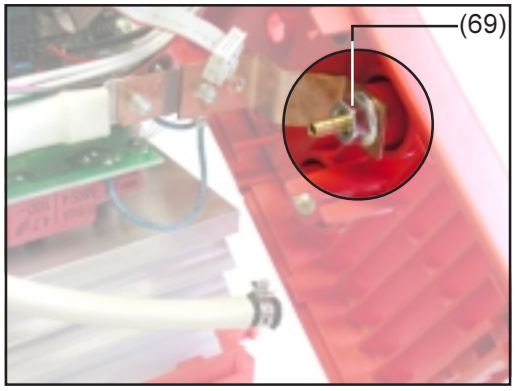


Fig.12

- **TP 1500 TIG:** Loosen the hexagon nut (69) (width-across=13) for the screw-fixing of the ⊖ socket

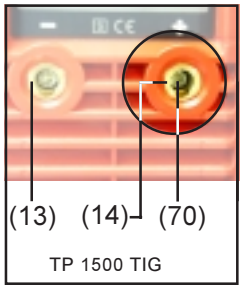


Fig.13

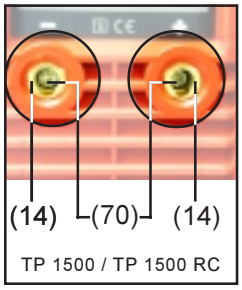


Fig.14

- **TP 1500 TIG:** In the ⊖ socket, loosen the M5x12 (TX20) screw (70)
- **TP 1500 / TP 1500 RC:** In the ⊕ socket and in the ⊖ socket, loosen the M5x12 (TX20) screw (70)
- Working from the inside of the housing towards the outside, push the welding sockets (13) or (14) out of the front of the housing

Removing the front of the housing

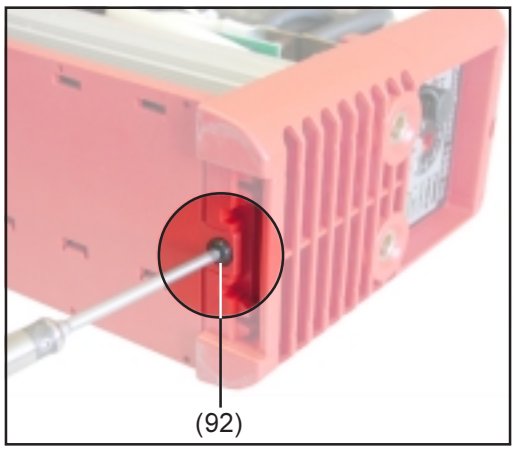


Fig.15

- Undo the 5x10 - TX20 screw on the floor of the housing

Removing the front of the housing (continued)

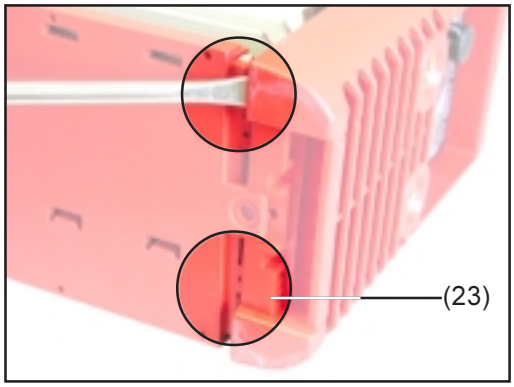


Fig.16

- Prise the front of the housing (23) off the floor of the housing

Fitting the front of the housing

Note! Before affixing the adhesive label (26), (27) or (28), clean the front of the housing.

- Affix the adhesive label (26), (27) or (28) to the front of the housing
- Press the front of the housing (23) onto the floor of the housing until it snaps into the catches

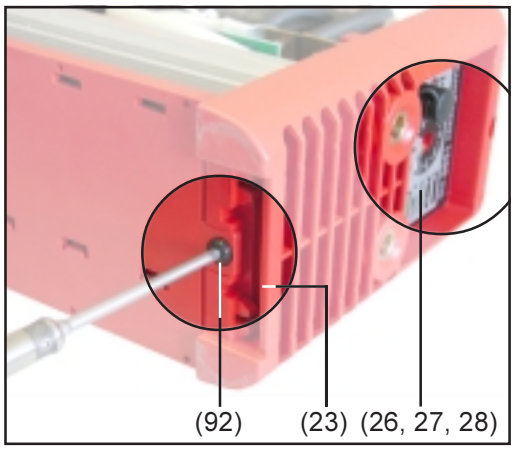


Fig.17

- Screw the 5x10 - TX20 screw into the floor of the housing

Fitting the welding sockets

- Working from the outside, insert welding sockets (13) and (14) into the front of the housing (Fig.13 and Fig.14)
- **TP 1500 TIG:** Screw the ⊕ socket to the appropriate copper bracket in the inside of the housing, using the M5x12 - TX20 screw (70)
  - Tighten the M5x12 - TX20 screw (70) with a torque of 2 Nm, holding the copper bracket firmly as you do so
- **TP 1500 / 1500 RC:** Screw the ⊕ socket and the ⊖ socket to the appropriate copper brackets in the inside of the housing, using M5x12 - TX20 screws (70)
  - Tighten the M5x12 - TX20 screws (70) with a torque of 2 Nm, holding the copper brackets firmly as you do so

Fitting the welding sockets
(continued)

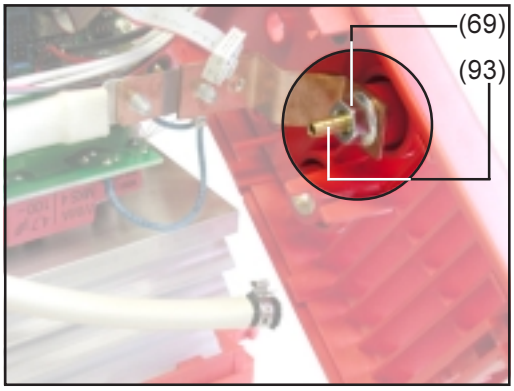


Fig.18

- **TP 1500 TIG:** Loosely screw on the hexagon nut (69) (width-across = 13) of the threaded join between the ⊖ socket and the copper bracket.

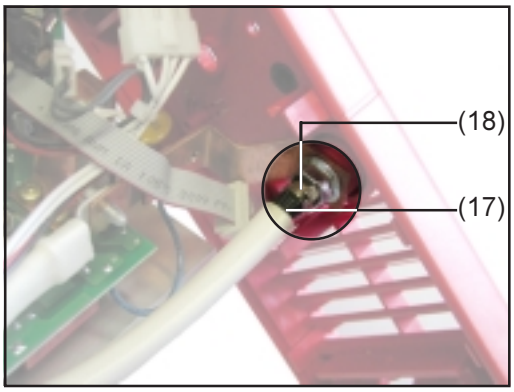


Fig.19

Note! TP 1500 TIG: Use a new hose clamp (18) to fasten the gas hose (17).

- **TP 1500 TIG:** Push the gas hose (17) onto the gas connector (93) of the ⊖ socket and fasten it with a hose clamp (18) (Fig.17)

Fitting the seal for the remote-control unit connection socket

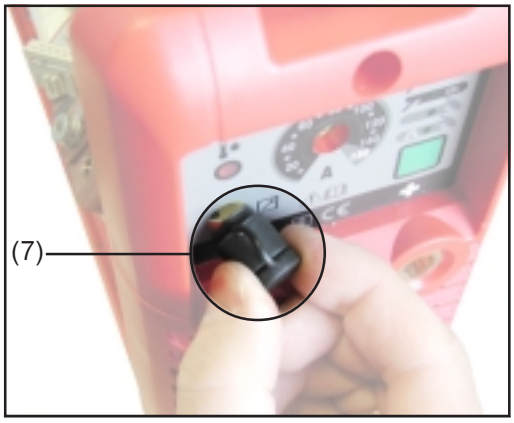


Fig.20

- Carefully insert the seal (7) for the remote-control unit connection socket into the front of the housing

Note! Before placing the FPA15 board (5) onto the alignment pins, do the following:

- TP 1500 RC / 1500 TIG: Apply a thin film of lubricant to the seal (7) for the remote-control unit connection socket (Fig.21)
- TP 1500 RC / 1500 TIG: Gently press the seal (7) for the remote-control unit connection socket, to prevent it being forced out when the FPA15 board is pushed into place
- To begin with, snap the FPA15 (5) into place on the rear alignment pin

Fitting the FPA15 board

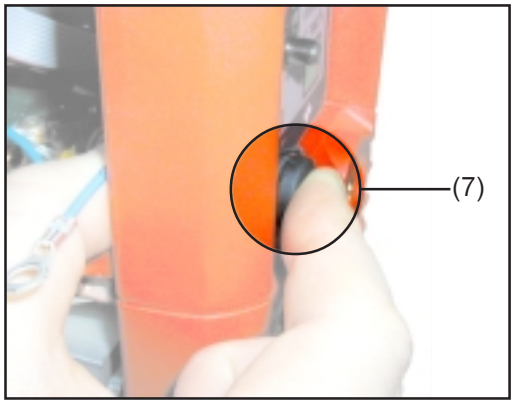


Fig.21

- Carefully press the FPA15 board until all the alignment pins have snapped into place

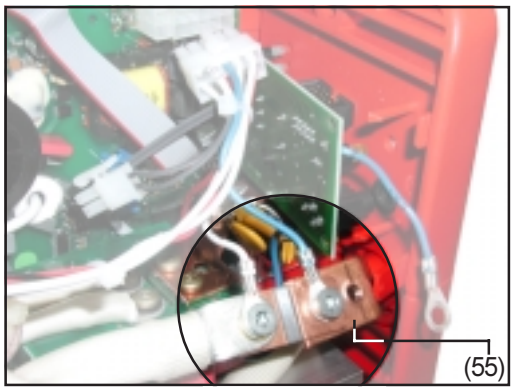


Fig.22

- Swing the copper bracket (55) back into its original position

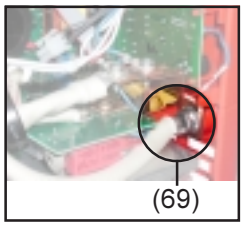


Fig.23

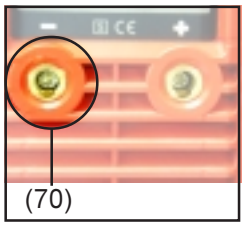


Fig.24

- **TP 1500 TIG:** Tighten the hexagon nut (69) (width-across=13) for the screw-fixing of the ⊖ socket
- **TP 1500 / 1500 RC:** In the ⊖ socket, tighten the M5x12 (TX20) screw (70) with a torque of 2 Nm

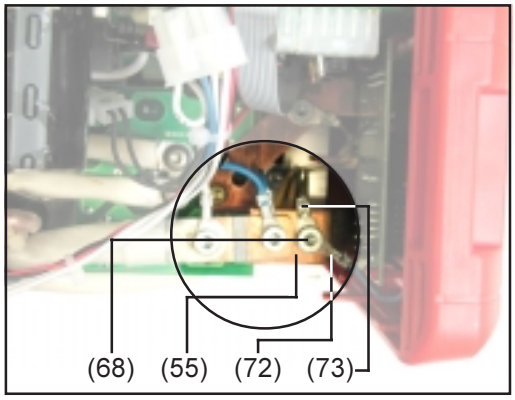


Fig.25

- Fasten the X3 cable (blue) (72) and the by-pass capacitors (73) onto the copper bracket (55), using the 5x12 - TX20 screw (68)
- Tighten the 5x12 - TX20 screw (68) with a torque of 2 Nm

Fitting the FPA15 board
(continued)

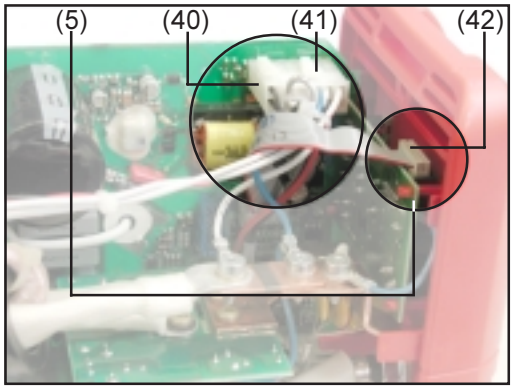


Fig.24

- Plug the 10-pole Molex plug (41) onto board LCA15
- Plug the 2-pole Molex plug (40) onto board LCA15
- Arrange the ribbon cable (42) above the cable harness, as shown in Fig.15
- Plug the ribbon cable (42) to board FPA15 (5)

Closing the housing

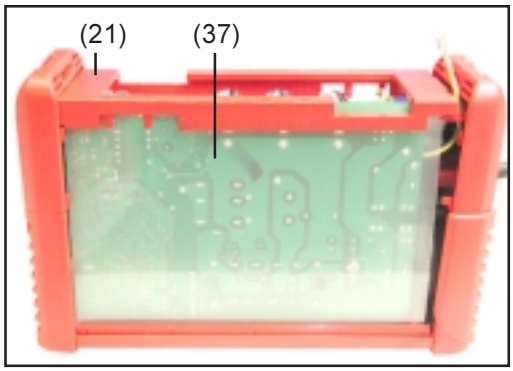


Fig.25

- Insert the board insulator (37)
- Insert the housing stiffening element (21)

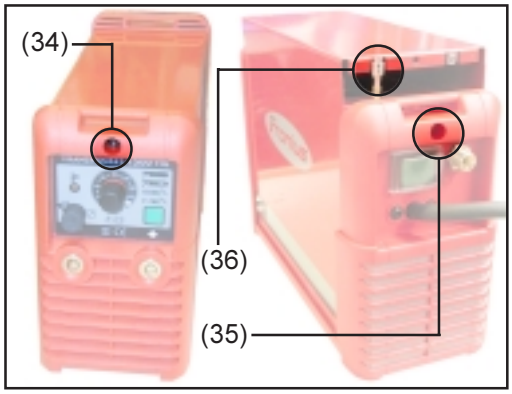


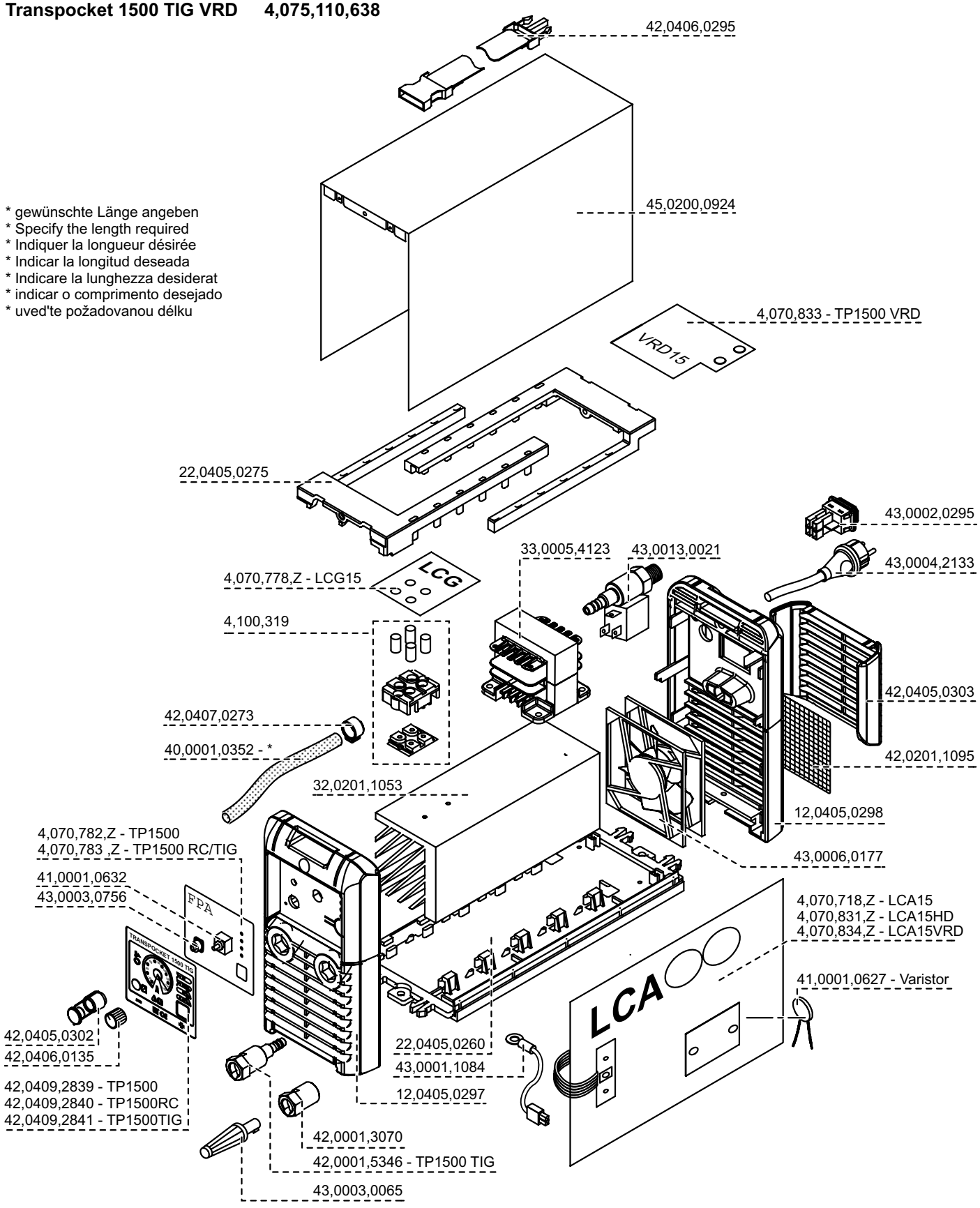
Fig.26

- Plug the “housing earth conductor” (36) onto the housing box, in the correct position
- Replace the housing box
- Screw the 5x25-TX20 screw (35) back onto the rear of the housing
- Screw the 5x25-TX20 screw (34) back onto the front of the housing
- Fit the carrying strap back on again

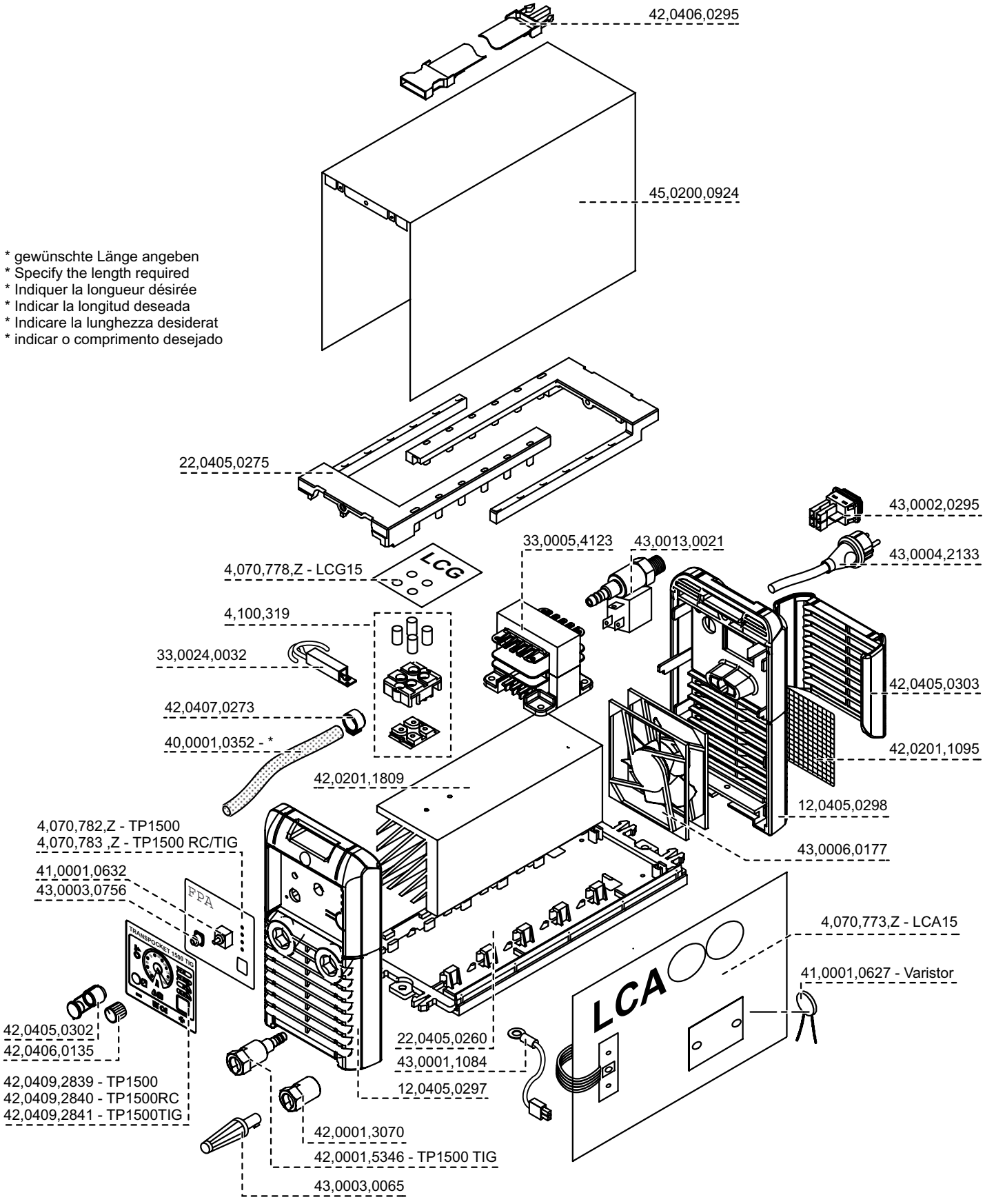
GB

Transpocket 1500	**4,075,108**
Transpocket 1500 VRD	**4,075,108,638**
Transpocket 1500 RC	**4,075,109**
Transpocket 1500 RC HD	**4,075,109,631**
Transpocket 1500 TIG	**4,075,110**
Transpocket 1500 TIG VRD	**4,075,110,638**

* gewünschte Länge angeben
* Specify the length required
* Indiquer la longueur désirée
* Indicar la longitud deseada
* Indicare la lunghezza desiderat
* indicar o comprimento desejado
* uved'te požadovanou délku



Transpocket 1500 Erdstrom **4,075,108,632**
Transpocket 1500 RC Erdstrom **4,075,109,632**
Transpocket 1500 TIG Erdstrom **4,075,110,632**



Fronius Worldwide - www.fronius.com/addresses

(A) **FRONIUS International GmbH**
4600 Wels, Buxbaumstraße 2
Tel: +43 (0)7242 241-0
Fax: +43 (0)7242 241-3940
E-Mail: sales@fronius.com
http://www.fronius.com

4600 Wels, Buxbaumstraße 2
Tel: +43 (0)7242 241-0
Fax: +43 (0)7242 241-3490
Service: DW 3070, 3400
Ersatzteile: DW 3390
E-Mail: sales.austria@fronius.com

6020 Innsbruck, Amraserstraße 56
Tel: +43 (0)512 343275-0
Fax: +43 (0)512 343275-725

5020 Salzburg, Lieferinger Hauptstr.128
Tel: +43 (0)662 430763
Fax: +43 (0)662 430763-16

1100 Wien, Daumegasse 7,
Team Süd / Ost
Tel: +43 (0)1/600 41 02-7410
Fax: +43 (0)1/600 41 02-7490
Team Nord / West
Tel: +43 (0)1/600 41 02-7050
Fax: +43 (0)1/600 41 02-7160

Haberkorn Ulmer GmbH
6961 Wolfurt, Hohe Brücke
Tel: +43 (0)5574 695-0
Fax: +43 (0)5574 2139
http://www.haberkorn.com

Wilhelm Zultner & Co.
8042 Graz, Schmiedlstraße 7
Tel: +43 (0)316 6095-0
Fax: +43 (0)316 6095-80
Service: DW 325, Ersatzteile: DW 335
E-Mail: vkm@zultner.at

Wilhelm Zultner & Co.
9020 Klagenfurt, Fallegasse 3
Tel: +43 (0)463 382121-0
Fax: +43 (0)463 382121-40
Service: DW 430, Ersatzteile: DW 431
E-Mail: vkk@zultner.at

(BR) **FRONIUS do Brasil LTDA**
Av. Senador Vergueiro, 3260
Vila Tereza, Sao Bernado do Campo - SP
CEP 09600-000, SÃO PAULO
Tel: +55 (0)11 4368-3355
Fax: +55 (0)11 4177-3660
E-Mail: sales.brazil@fronius.com

(CH) **FRONIUS Schweiz AG**
8153 Rümlang, Oberglatterstraße 11
Tel: +41 (0)1817 9944
Fax: +41 (0)1817 9955
E-Mail: sales.switzerland@fronius.com

(CZ) **FRONIUS Èeská republika s.r.o.**
381 01 ÈESKÝ KRUMLOV, Tovární 170
Tel: +420 380 705 111
Fax: +420 380 711 284
E-Mail: sales.c.krumlov@fronius.com

100 00 PRAHA 10, V Olšinách 1022/42
Tel.: +420 272 111 011, 272 742 369
Fax: +420 272 738 145
E-Mail: sales.praha@fronius.com

315 00 PLZEÒ-Bo•kov, Letkovská 38
Tel: +420 377 183 411
Fax: +420 377 183 419
E-Mail: sales.plzen@fronius.com

500 04 HRADEC KRÁLOVÉ,
Pra•ská 293/12
Tel.: +420 495 070 011
Fax: +420 495 070 019
E-Mail: sales.h.kralove@fronius.com

(CZ) 586 01 JIHLAVA, Brnìnská 65
Tel: +420 567 584 911
Fax: +420 567 305 978
E-Mail: sales.jihlava@fronius.com

709 00 OSTRAVA - Mariánské Hory,
Kollárova 3
Tel: +420 595 693 811
Fax: +420 596 617 223
E-Mail: sales.ostrava@fronius.com

760 01 ZLÍN
ul. Malá (za èerp. st. ARAL)
Tel: +420 577 311 011
Fax: +420 577 311 019
E-Mail: sales.zlin@fronius.com

(D) **FRONIUS Deutschland GmbH**
67661 Kaiserslautern, Liebigstraße 15
Tel: +49 (0)631 35127-0
Fax: +49 (0)631 35127-50
E-Mail: sales.germany@fronius.com

90530 Wendelstein,
Wilhelm-Maisel-Straße 32
Tel: +49 (0)9129 2855-0
Fax: +49 (0)9129 2855-32

51149 Köln, Gremberghoven,
Welserstraße 10 b
Tel: +49 (0)2203 97701-0
Fax: +49 (0)2203 97701-10

57052 Siegen, Alcher Straße 51
Tel: +49 (0)271 37515-0
Fax: +49 (0)271 37515-15

38640 Goslar, Im Schleeke 108
Tel: +49 (0)5321 3413-0
Fax: +49 (0)5321 3413-31

10365 Berlin, Josef-Orlopp-Str. 92-106
Tel: +49 (0)30 557745-0
Fax: +49 (0)30 557745-51

21493 Talkau, Dorfstraße 4
Tel: +49 (0)4156 8120-0
Fax: +49 (0)4156 8120-20

70771 Leinfelden-Echterdingen
(Stuttgart),
Kolumbus-Straße 47
Tel: +49 (0)711 782852-0
Fax: +49 (0)711 782852-10

04328 Leipzig, Riesaer Straße 72-74
Tel: +49 (0)341 27117-0
Fax: +49 (0)341 27117-10

01723 Kesselsdorf (Dresden),
Zum alten Dessauer 13
Tel: +49 (0)35204 7899-0
Fax: +49 (0)35204 7899-10

67753 Hefersweiler, Sonnenstraße 2
Tel: +49 (0)6363 993070
Fax: +49 (0)6363 993072

18059 Rostock, Erich Schlesinger Str. 50
Tel: +49 (0)381 4445802
Fax: +49 (0)381 4445803

81379 München, Gmunder Straße 37a
Tel: +49 (0)89 748476-0
Fax: +49 (0)89 748476-10

83308 Trostberg, Pechleraustraße 7
Tel: +49 (0)8621 8065-0
Fax: +49 (0)8621 8065-10

94491 Hengersberg, Donaustraße 31
Tel: +49 (0)9901 2008-0
Fax: +49 (0)9901 2008-10

(F) **FRONIUS France SARL**
60306 SENLIS CEDEX,
13 avenue Félix Louat - B.P.195
Tél: +33 (0)3 44 63 80 00
Fax: +33 (0)3 44 63 80 01
E-Mail: sales.france@fronius.com

(N) **FRONIUS Norge AS**
3056 Solbergelva, P.O. BOX 32
Tel: +47 (0)32 232080,
Fax: +47 (0)32 232081
E-Mail: sales.norway@fronius.com

(SK) **FRONIUS Slovensko s.r.o.**
917 01 Trnava, Nitrianská 5
Tel: +421 (0)33 590 7511
Fax: +421 (0)33 590 7599
E-Mail: sales.slovakia@fronius.com

974 03 Banská Bystrica,
Zvolenská cesta 14
Tel: +421 (0)48 472 0611
Fax: +421 (0)48 472 0699
E-Mail: sales.b.bystrica@fronius.com

(UA) **FRONIUS Ukraine GmbH**
07455 Ukraine, Kiewskaya OBL..,
S. Knjashitschi, Browarskogo R-NA
Tel: +38 044 94-62768
+38 044 94-54170
Fax: +38 044 94-62767
E-Mail: sales.ukraine@fronius.com

(USA) **FRONIUS USA LLC**
10503 Citation Drive,
Brighton, Michigan 48116
Tel: +1(0) 810 220-4414
Fax: +1(0) 810 220-4424
E-Mail: sales.usa@fronius.com

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